APRIL 1959
VOL. 1 NO. 4

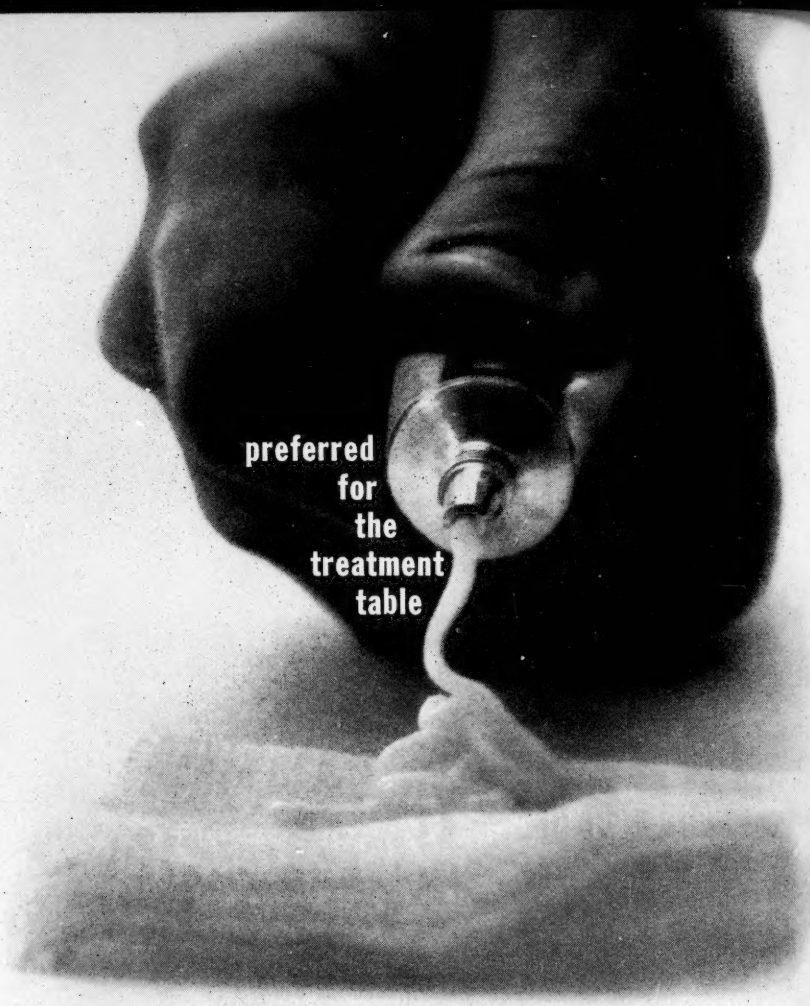
journal of occupational medicine

IN THIS ISSUE

- RADIATION AS AN INDUSTRIAL MEDICAL PROBLEM ..... *Charles M. Dunham, M.D.*
- A COMPARISON OF RAILROAD AND STEEL MILL LOST TIME CASES ..... *Robert J. Halen, M.D.*
- PHYSIOLOGICAL PROBLEMS OF SPACE FLIGHT ..... *Lieut. Col. Stanley C. White (MC), USAF and Capt. Charles L. Wilson (MC), USAF*
- CANCER DETECTION ACTIVITIES IN INDUSTRY ..... *T. J. Bulger, M.D., and A. J. Fleming, M.D.*
- SPECIAL ARTICLE
  The Legal Scope of Industrial Nursing Practice
- TOPICAL REVIEWS
  Beryllium Disease—A Review of Current Knowledge ..... *Harriet L. Hardy, M.D. and Lloyd B. Tepper, M.D.*
  Noise and Hearing Loss ..... *Lieut. Cmdr. Norbert E. Rosenwinkel (MC) U.S.N., et al.*
  Part II. Recognition of the Hazard
  Occupational Skin Problems ..... *Raymond R. Suskind, M.D.*
  Part III. Case Study and Diagnostic Appraisal

Complete Table of Contents on Page *3a*

OFFICIAL PUBLICATION OF THE INDUSTRIAL MEDICAL ASSOCIATION



because Neo-Polycin Ointment

helps clear topical infections promptly

Neo-Polycin® provides neomycin, bacitracin and polymyxin, the three antibiotics preferred for topical use because this combination is effective against the *entire* range of bacteria causing most topical infections...has a low index of sensitivity...and averts the risk of sensitization to lifesaving antibiotics, since these agents are rarely used systemically. And Neo-Polycin provides these three antibiotics in the unique Fuzene® base, which releases higher antibiotic concentrations than is possible with grease-base ointments.

Each gram of Neo-Polycin contains 3 mg. of neomycin, 400 units of bacitracin and 8000 units of polymyxin B sulfate in the unique Fuzene base. Supplied in 15 Gm. tubes

PITMAN-MOORE COMPANY, DIVISION OF ALLIED LABORATORIES, INC., INDIANAPOLIS 6, INDIANA

Vol. 1 No. 4
ISSUE OF APRIL 1959

Journal of Occupational Medicine

Official Publication of the Industrial Medical Association

TABLE OF CONTENTS

TEXT SECTION

Original Articles

RADIATION AS AN INDUSTRIAL MEDICAL PROBLEM 199
Charles M. Dunham, M.D.

A COMPARISON OF RAILROAD AND STEEL MILL LOST TIME CASES 203
Robert J. Halen, M.D.

PHYSIOLOGICAL PROBLEMS OF SPACE FLIGHT 207
Lieut. Col. Stanley C. White (MC), USAF, and Capt. Charles L. Wilson (MC), USAF

CANCER DETECTION ACTIVITIES IN INDUSTRY—ELEVEN YEAR FOLLOW-UP REPORT 211
T. J. Bulger, M.D., and A. J. Fleming, M.D.

Special Article

THE LEGAL SCOPE OF INDUSTRIAL NURSING PRACTICE 215

Topical Reviews

BERYLLIUM DISEASE—A REVIEW OF CURRENT KNOWLEDGE 219
Harriet L. Hardy, M.D., and Lloyd B. Tepper, M.D.

NOISE AND HEARING LOSS—II. RECOGNITION OF THE HAZARD 225
Lieut. Cmdr. Norbert E. Rosenwinkel (MC), U.S.N., Kenneth C. Stewart, M.S., and Leo G. Doerfler, Ph.D.

OCCUPATIONAL SKIN PROBLEMS—III. CASE STUDY AND DIAGNOSTIC APPRAISAL 230
Raymond R. Suskind, M.D.

Editorial

ERGONOMICS 237
The President's Message 238
Book Reviews 239

Abstracts

EXPERIMENTAL TOXICOLOGY 243
Robert E. Eckardt, Ph.D., M.D.

MEDICAL CARE ADMINISTRATION 244
Asa Barnes, M.D.

DERMATOLOGY 245
Donald J. Birmingham, M.D.

REPARATIVE SURGERY 246
Robert J. Trettin, M.D.

INTERNAL MEDICINE 247
Shermer H. Stradley Jr., M.D.

NOISE AND HEARING 249
H. O. Parrack, Ph.D.

INDUSTRIAL HYGIENE 250
Edward C. Riley, M.D.

CLINICAL TOXICOLOGY 251
Lee H. Miller, M.D., I.M.D.

MENTAL HEALTH 252
Graham C. Taylor, M.D.

RADIATION HEALTH 253
Thomas S. Ely, M.D.

GENERAL SECTION

Industrial Medical Association

OFFICERS AND DIRECTORS *6a*
DISTRICT COUNSELORS *8a*
COMPONENT SOCIETIES *10a*
COMMITTEES *12a*
ASSOCIATION ACTIVITIES *14a*
About the Authors *19a*
People and Events *21a*
List of Advertisers *24a*

Journal of Occupational Medicine is published by the Industrial Medical Association, 28 East Jackson Boulevard, Chicago 4, on the 15th of each month. Application for entry as second class matter pending at Chicago, Illinois. Copyright 1959 by the Industrial Medical Association.

Subscriptions $10.00 per year—U. S. and foreign. Single copies $1.00 postpaid. Make checks payable to Journal of Occupational Medicine.

Change of address notices received by the end of any month will assure delivery of the following month's issue. Address change is facilitated if old address is also furnished.

Subscriptions, changes of address, and all business matters, including advertising, should be addressed to Clark D. Bridges, Publication Manager, Journal of Occupational Medicine, 28 East Jackson Boulevard, Chicago 4.

Manuscripts submitted for publication should be sent direct to the Editor, Adolph G. Kammer, M.D., 2057 Beechwood Boulevard, Pittsburgh 17, Pennsylvania.

Journal of Occupational Medicine

Official Publication of the Industrial Medical Association

EDITOR

ADOLPH G. KAMMER, M.D.
University of Pittsburgh
Pittsburgh, Pennsylvania

EDITORIAL BOARD

PAUL J. BAMBERGER, M.D.
Bethlehem, Pennsylvania

RUSSELL G. BIRRELL, M.D.
Toronto, Ontario

RONALD F. BUCHAN, M.D.
Boston, Massachusetts

EDWARD V. HENSON, M.D.
South Charleston, W. Va.

FRANK PRINCI, M.D.
Cincinnati, Ohio

IRWIN SCHULZ, M.D.
Milwaukee, Wisconsin

LITERATURE ABSTRACTERS

Dermatology
DONALD J. BIRMINGHAM, M.D.
RAYMOND R. SUSKIND, M.D.
Cincinnati, Ohio

Noise & Hearing
H. O. PARRACK, Ph.D.
Wright-Patterson Air
Force Base, Ohio

Internal Medicine
SHERMER H. STRADLEY JR., M.D.
Wilmington, Delaware
JOHN J. THORPE, M.D.
LEO J. WADE, M.D.
New York, New York

Medical Care Administration
ASA BARNES, M.D.
Louisville, Kentucky

Mental Health
GRAHAM C. TAYLOR, M.D.
Montreal, Quebec

Industrial Hygiene
EDWARD C. RILEY, M.D.
Rochester, New York

Orthopedic Surgery
OWEN E. MILLER, M.D.
Milwaukee, Wisconsin
ROBERT W. BAILEY, M.D.
Ann Arbor, Mich.

Radiation Health
THOMAS S. ELY, M.D.
Washington, D. C.

Reparative Surgery
JOSEPH M. DZIOB, M.D.
Lackawanna, New York
ROBERT J. TRETTIN, M.D.
Milwaukee, Wis.

Clinical Toxicology
LEE H. MILLER, M.D., I.M.D.
Cincinnati, Ohio

Experimental Toxicology
ROBERT E. ECKARDT, Ph.D., M.D.
Linden, New Jersey

PUBLICATION MANAGER

CLARK D. BRIDGES
28 E. Jackson Blvd., Chicago 4, Illinois

SUGGESTIONS TO AUTHORS

Materials for publication should be addressed to the Editor, 2057 Beechwood Boulevard, Pittsburgh 17. Articles will be considered for publication on condition that they are submitted solely to the *Journal of Occupational Medicine*.

The manuscript, including references, footnotes, and legends for illustrations, should be typed on one side of a standard-sized page of opaque paper, double-spaced, and with at least a one inch margin at each edge. One carbon copy should accompany the original typescript, and the author should retain a carbon copy for use in reading galley proofs.

The authors' names should be accompanied by the highest academic or medical degrees that they hold; letters indicating membership in honor or professional societies will not be published. Authors who are in the armed services should not use civilian degrees in connection with their names. The city of each author should be supplied, and an address should be provided at the end of the manuscript for the use of readers who may wish to communicate with the senior author. If academic, hospital, or industrial connections are given for one author, they must be given for all other authors who have such connections. The authors are responsible for obtaining permission from the proper authorities to use the names of institutions.

References to the literature should be limited to those used in preparation of the manuscript; they should be typed on a special page at the end of the manuscript and should be in the style of those used in the scientific publications of the American Medical Association. Titles of all articles must be given.

Charts and drawings should be in black ink on hard, white paper. Lettering should be large enough to permit necessary reduction. Oversized illustrations should be photographed and a glossy print submitted. Prints of a bluish tinge will not reproduce well. Paper clips must not be used on prints, since the marks left will show in the reproduction. A label should be pasted to the back of each illustration showing its number, the author's name, an abbreviated title of the article, and an indication of the top of the picture. Each chart and illustration must have a descriptive legend, and each table must have a caption.

new

for total management of itching,[1,2] inflamed,[3,4] infected[5,6] skin lesions

Dermatitis repens [with staph and monilia] 7 weeks duration

Cleared in 5 days

Mycolog ointment

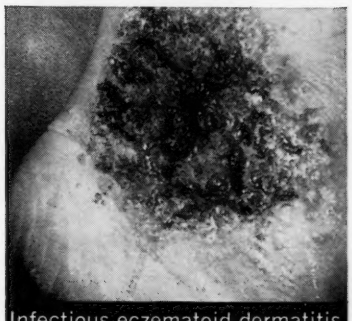
Kenalog, Spectrocin and Mycostatin in Plastibase

antipruritic/anti-inflammatory/antibacterial/antifungal

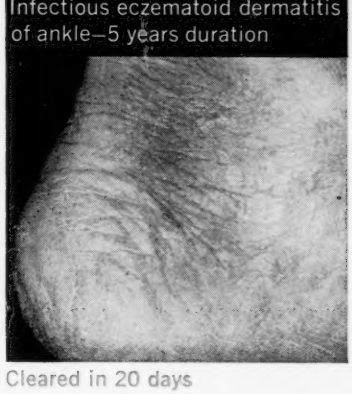
Mycolog Ointment – containing the new superior topical corticoid Kenalog – reduces inflammation,[3,4] relieves itching,[1,2] and combats or prevents bacterial, monilial and mixed infections.[5-7] It is extremely well tolerated, and assures a rapid, decisive clinical response for most infected dermatoses.

> "Thirty-one of 38 patients . . . obtained excellent or good control of dermatological lesions . . . [Mycolog] was highly effective, particularly in the management of mixed infections. Several recalcitrant eruptions which had not responded to previous therapy were remarkably responsive to the daily application of this preparation over periods of 2 to 3 weeks."[5]

For total management of itching, inflamed, infected skin lesions, Mycolog contains triamcinolone acetonide, an outstanding new topical corticoid for prompt, effective relief of itching, burning and inflammation[1-4] – neomycin and gramicidin for powerful antibacterial action[7] – and nystatin for treating or preventing Candida (Monilia) albicans infections.[8,9]



Infectious eczematoid dermatitis of ankle–5 years duration



Cleared in 20 days

Application: Apply 2 to 3 times daily. Supply: 5 Gm. and 15 Gm. tubes. Each gram supplies 1.0 mg. (0.1%) triamcinolone acetonide, 2.5 mg. neomycin base, 0.25 mg. gramicidin, and 100,000 units nystatin in PLASTIBASE.

References: 1. Shelmire, J.B., Jr.: Monographs on Therapy 3:164 (Nov.) 1958. · 2. Nix, T.E., Jr., and Derbes, V.J.: Monographs on Therapy 3:123 (Nov.) 1958. · 3. Robinson, R.C.V.: Bull. School of Med., U. Maryland 43:54 (July) 1958. · 4. Sternberg, T.H.: Newcomer, V.D., and Reisner, R.M.: Monographs on Therapy 3:115 (Nov.) 1958. · 5. Clark, R.F., and Hallett, J.J.: Monographs on Therapy, 3:153 (Nov.) 1958. · 6. Smith J.G., Jr.; Zawisza, R.J., and Blank, H.: Monographs on Therapy, 3:111 (Nov.) 1958. · 7. Monographs on Therapy, 3:137 (Nov.) 1958. · 8. Howell, C.M., Jr.: North Carolina M.J. 19:449 (Oct.) 1958. · 9. Bereston, E.S.: South. M.J. 50:547 (April) 1957.

And whatever the topical corticoid need, a suitable Squibb formulation is available—Kenalog-S Lotion—7½ cc. plastic squeeze bottles. Each cc. supplies 1.0 mg. (0.1%) triamcinolone acetonide, 2.5 mg. neomycin base and 0.25 mg. gramicidin. Kenalog Cream, 0.1%—5 Gm. and 15 Gm. tubes. Kenalog Lotion, 0.1%—15 cc. plastic squeeze bottles. Kenalog Ointment, 0.1%—5 Gm. and 15 Gm. tubes.

RELIABILITY · INTEGRITY · PRODUCTS · RESEARCH · SQUIBB

SQUIBB

Squibb Quality — the Priceless Ingredient

'SPECTROCIN'®, 'MYCOSTATIN'®, 'PLASTIBASE'®, 'MYCOLOG' AND 'KENALOG' ARE SQUIBB TRADEMARKS

Industrial Medical Association

OFFICERS

President:
H. W. LAWRENCE, M.D.
The Procter and Gamble Co.
Cincinnati 17, Ohio

President-Elect:
D. JOHN LAUER, M.D.
Jones & Laughlin Steel Corporation
Pittsburgh 30, Pennsylvania

First Vice President:
R. E. ECKARDT, M.D.
Esso Research & Engineering Co.
Linden, New Jersey

Second Vice President:
GRADIE R. ROWNTREE, M.D.
Fawcett-Dearing Printing Co.
Louisville 1, Kentucky

Secretary:
LEONARD ARLING, M.D.
Northwest Industrial Clinic
3101 University Ave., S.E.
Minneapolis 14, Minnesota

Treasurer:
JOHN L. NORRIS, M.D.
Eastman Kodak Co.
Rochester 4, New York

DIRECTORS

1957 - 1959

L. E. CURTIS, M.D.
Standard Oil Company of California
225 Bush Street
San Francisco 20, California

GLENN S. EVERTS, M.D.
Curtis Publishing Company
Philadelphia 5, Pennsylvania

J. F. McCAHAN, M.D.
Western Electric Co.
Hawthorne Station
Chicago 23, Illinois

ROBERT B. O'CONNOR, M.D.
U. S. Steel Corporation
Pittsburgh, Pennsylvania

ARTHUR K. PETERSON, M.D.
R. R. Donnelley & Sons Company
350 East 22nd Street
Chicago 16, Illinois

NORBERT J. ROBERTS, M.D.
Standard Oil Co. (N.J.)
30 Rockefeller Plaza
New York 20, New York

1958 - 1961

DONALD C. BEWS, M.D.
Bell Telephone Company of Canada
1050 Beaver Hall Hill
Montreal, Quebec

ALLAN J. FLEMING, M.D.
E. I. du Pont de Nemours & Co.
Wilmington 98, Delaware

S. CHARLES FRANCO, M.D.
Consolidated Edison Co. of N. Y.
4 Irving Place
New York 3, N. Y.

H. GLENN GARDINER, M.D.
Inland Steel Company
East Chicago, Indiana

EMMETT B. LAMB, M.D.
International Harvester Co.
Indianapolis 4, Indiana

EXECUTIVE OFFICES

28 East Jackson Blvd. Chicago 4, Illinois
Telephone WAbash 2-4054

Managing Director: EDWARD C. HOLMBLAD, M.D.
Assistant Managing Director: CLARK D. BRIDGES
Executive Secretary: RITA KIRTLEY PACKER

The Industrial Medical Association was organized in 1915 as the American Association of Industrial Physicians and Surgeons. Its first annual meeting was held the following year. In 1951 the present name was adopted.

The purposes of the organization as stated in the certificate of incorporation (not-for-profit) are:

"The object of this Association will be to foster the study and discussion of the problems peculiar to industrial medicine and surgery; to develop methods adapted to the conservation of health among workers in the industries; to promote a more general understanding of the purposes of the medical care for employees; and to unite into one organization members of the medical profession specializing in industrial medicine and surgery for their mutual advancement in the practice of their profession."

Presently, the membership totals nearly 4000 physicians in the United States, Canada, Latin America, and other parts of the world. Physicians "who have an interest in Industrial Medicine" may apply for membership; specialization in this field is not essential. Regionally, the Industrial Medical Association has 14 Component Societies in the United States and one in Hawaii. Most Association members carry their membership through one of the component groups.

The Journal of Occupational Medicine, owned and published by the Industrial Medical Association, is sent monthly to each member as one of the advantages of membership.

The annual business meeting and convention is held in the spring. Since 1945, the convention has been held concurrently with the meetings of four other organizations having related interests—American Industrial Hygiene Association, American Conference of Governmental Industrial Hygienists, American Association of Industrial Nurses, Inc., American Association of Industrial Dentists. This combined meeting is known as the Industrial Health Conference.

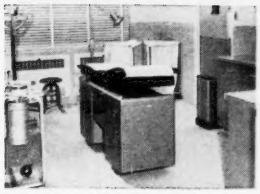
The Occupational Health Institute, Inc., is a nonprofit educational organization created by the Industrial Medical Association to promote the cause of health in industry. Since 1951, the Occupational Health Institute has conducted the program of evaluation, approval and certification of Medical Services in Industry, on the basis of standards established by the Standards Committee of the Industrial Medical Association. This program was conducted by the American College of Surgeons for many years until its transfer to the Association.

The Association's headquarters office serves as a focal point for the Association's activities, and through its coordination of information regarding industrial health problems encountered throughout the country, it offers invaluable assistance to members on a host of specific subjects.

ANNUAL MEETING & INDUSTRIAL HEALTH CONFERENCE

Sherman Hotel, Chicago **April 28, 29, 30, 1959**

SINCE 1860



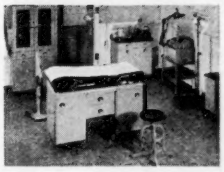
Everything You Need For Your Dispensary or Laboratory

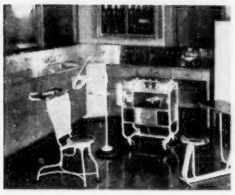
. . . *Plus Expert Help in Planning It*

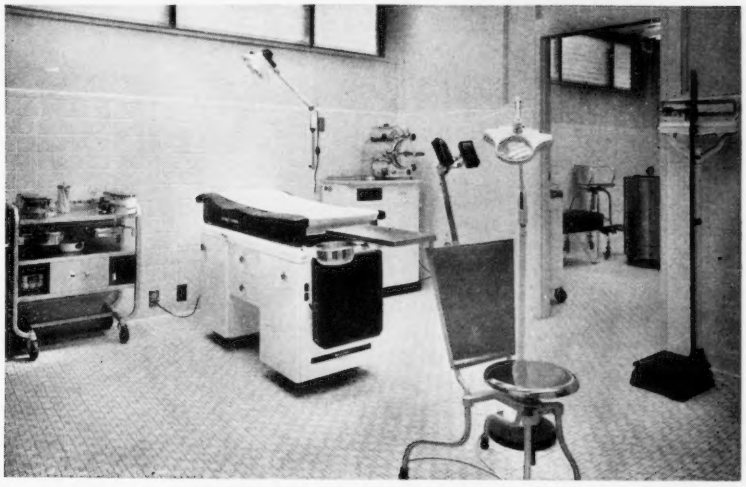
Aloe has equipped hundreds of medical departments and laboratories for the nation's leading corporations.
Aloe equipment comes direct from the Aloe factory to you, not through an intervening dealer. Thus, you benefit in two ways: (1) Better equipment at better prices; (2) Specific equipment designed following suggestions by industrial physicians and nurses. Moduline Customized-Unit Casework, Alumiline Dressing Carriage, Aloe Industrial Chair, Drainboard Extremity Dressing Rack, are a few of the Aloe manufactured items most often selected.

Our experienced equipment engineers can help you prepare floor plans, check lists, and budget estimates; saving valuable time, reducing costs, eliminating costly estimates in planning.

For complete details write or mail coupon below.







A. S. ALOE COMPANY

1831 Olive Street, St. Louis 3, Mo.

Complete Equipment for the Industrial Dispensary and Laboratory

16 FULLY-STOCKED DIVISIONS COAST-TO-COAST

A. S. ALOE COMPANY
1831 Olive St., St. Louis 3, Mo.

Please tell us how you can help to plan and equip ☐ Industrial Dispensary; ☐ Laboratory.

Name_____

Address_____

City_____ Zone____ State_____

Industrial Medical Association

DISTRICTS AND COUNSELORS

District

1 R. C. THOMPSON, M.D.
General Electric Company
West Lynn, Massachusetts
Maine, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island.

2 HAROLD BRANDALEONE, M.D.
116 East 63rd Street
New York 21, New York
Metropolitan New York, Northern New Jersey.

3 JAMES H. McDONOUGH, M.D.
Rome Cable Corporation
Rome, New York
Niagara Frontier District.

4 GILBERT B. MEYERS, M.D.
Radio Corp. of America
Camden, N. J.
Eastern Pennsylvania, Southern New Jersey, Delaware.

5 WALTER E. FLEISCHER, M.D.
Armco Steel Corporation
3400 East Chase, Baltimore 13
Maryland, District of Columbia, Virginia.

6 LOGAN T. ROBERTSON, M.D.
P.O. Box 2509, Asheville, N. C.
North Carolina, South Carolina.

7 JOE M. BOSWORTH, M.D.
Liberty Mutual Insurance Co.
Atlanta, Georgia
Florida, Georgia.

8 JOSEPH A. LLEWELLYN, M.D.
Armco Steel Corporation
Butler, Pennsylvania
Western Pennsylvania, West Virginia.

9 PAUL A. DAVIS, M.D.
633 East Market Street, Akron 4
Eastern Ohio.

10 ERVIN C. BINSTADT, M.D.
Cincinnati Milling Machine Co.
Cincinnati, Ohio
Western Ohio.

11 WILFRED N. SISK, M.D.
The Upjohn Company
Kalamazoo, Michigan
Michigan.

District

12 JULIAN E. WILLIAMS, M.D.
Tennessee-Eastman Corporation
Kingsport, Tennessee
Tennessee.

13 E. H. KREMER, JR., M.D.
1100 Francis Bldg.
Louisville 2, Kentucky
Kentucky

14 HARRY VERNON SIMS, M.D.
317 Baronne St., New Orleans 9
Mississippi, Louisiana.

14A WILLIAM G. THUSS, JR., M.D.
2230 Third Avenue, North
Birmingham 3, Alabama
Alabama.

15 ALLAN K. HARCOURT, M.D.
812 Chamber of Commerce Building, Indianapolis
Indiana.

15A E. L. WALSH, M.D.
International Harvester Co.
180 North Michigan, Chicago
Illinois.

16 GEORGE H. PETERSON, M.D.
Fairbanks, Morse & Company
Beloit, Wisconsin
Wisconsin and Upper Michigan Peninsula.

17 JOHN F. SHRONTS, M.D.
General Mills, Inc.
Minneapolis 26, Minnesota
Minnesota, North Dakota, Iowa, South Dakota.

18 WILLIAM L. MACON, JR., M.D.
7200 Manchester Blvd.
St. Louis 17, Missouri
Missouri.

18A G. PRENTISS McARDLE, M.D.
1216 Medical Arts Building
Omaha, Nebraska
Kansas and Nebraska.

19 TOM HALL MITCHELL, M.D.
Carter Oil Company
Tulsa, Oklahoma
Arkansas, Oklahoma.

20 ROBERT J. POTTS, M.D.
9229 Vinewood Drive
Dallas, Texas
Northern Texas.

District

21 ROBERT A. WISE, M.D.
Humble Oil & Refining Co.
Houston, Texas
Southern Texas.

22 GEORGE L. VOELZ, M.D.
Atomic Energy Commission
Idaho Falls, Idaho
Montana, Idaho.

23 ROSCOE H. REEVE, M.D.
Standard Oil & Affiliated Cos.
312 Wyoming National Bank Building, Casper, Wyoming
Wyoming, Colorado, Utah, Nevada.

24 CARL H. GANS, M.D.
Morenci Hospital
Morenci, Arizona
Arizona, New Mexico.

25 CHARLES M. McGILL, M.D.
Puget Sound Medical Bldg.
4th and K Streets, Tacoma
Washington.

26 FORREST E. RIEKE, M.D.
1313 Northwest 19th Avenue
Portland 9, Oregon
Oregon.

27 JOHN E. KIRKPATRICK, M.D.
516 Sutter Street, San Francisco
Northern California, Bay Area.

28 CLARENCE LEE LLOYD, M.D.
North American Aviation, Inc.
Los Angeles
Southern California.

29 WILLIAM H. WILKINSON, M.D.
373 Kilani Avenue
Wahiawa, Oahu, T.H.
Territory of Hawaii.

30 EDWIN A. TURCOT, M.D.
Imperial Oil, Ltd.
Montreal East 5, Que., Can.

31 R. G. WARMINGTON, M.D.
Cyanamid of Canada Limited
P.O. Box 330
Niagara Falls, Ontario
Ontario.

32 A. JOHN NELSON, M.D.
British Columbia Electric Co.
Vancouver 4, British Columbia
Western Canada.

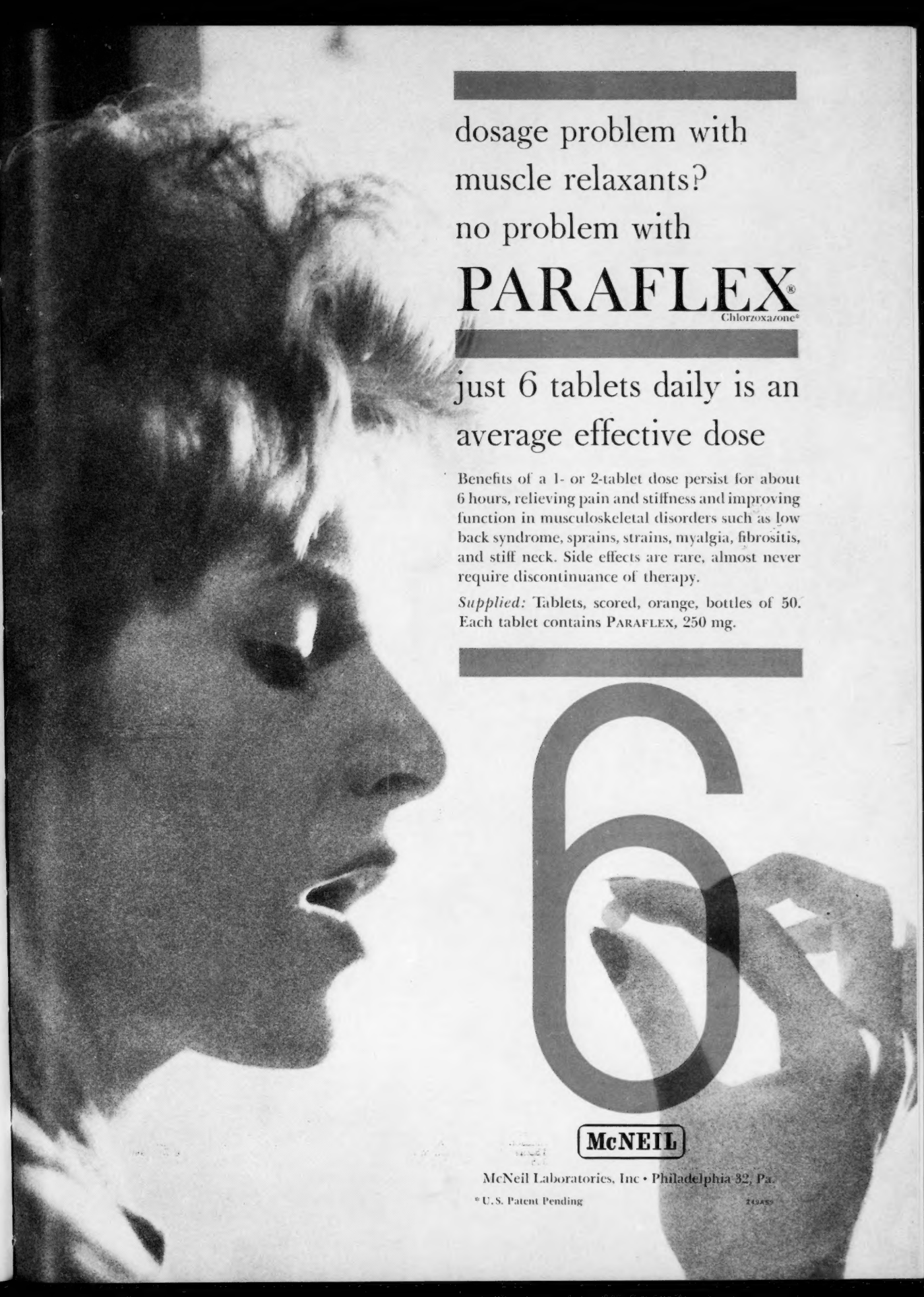
Through its District Counselors, the Industrial Medical Association is represented regionally throughout the United States, Canada and in Hawaii. There are 35 districts, each served by a Counselor appointed by the President of the Association. The District Counselor reflects the attitude of the membership of his district in his relations with the national organization, and in turn, reports and interprets policies of the Association to the membership and the general public in his district.

An important function of the District Counselor is to serve in a liaison capacity with the Component Society of the Industrial Medical Association in his area. The District Counselor also is concerned with regional trends in industrial medical practice and in legislation bearing upon medical service in industry. He is ready to assist any physician with questions or problems.

In promoting the cause of industrial medicine, many District Counselors work with the industrial health committees of their state medical societies, they participate in teaching programs at hospitals or medical schools, and serve as speakers at meetings of groups that express interest in occupational health. Throughout these activities, the District Counselor attempts to stimulate membership in the Industrial Medical Association by acquainting others with the organization's purposes and facilities.

By keeping in close contact with members in his area, the District Counselor gains a familiarity with their work which enables him to make recommendations to the Association's officers and committees regarding those qualified for various positions or honors. He recommends members for committee work, and for fellowship, and recommends fellows for consideration for elective offices in the Association. He also recommends possible recipients for the awards presented at the annual meeting of the Association—the Knudsen Award, the Health Achievement in Industry Award, the Meritorious Service Award and the Merit in Authorship Award.

Many District Counselors also serve as Regional Consultants for the Occupational Health Institute, the educational affiliate of the IMA.



dosage problem with
muscle relaxants?
no problem with

PARAFLEX®

Chlorzoxazone*

just 6 tablets daily is an average effective dose

Benefits of a 1- or 2-tablet dose persist for about 6 hours, relieving pain and stiffness and improving function in musculoskeletal disorders such as low back syndrome, sprains, strains, myalgia, fibrositis, and stiff neck. Side effects are rare, almost never require discontinuance of therapy.

Supplied: Tablets, scored, orange, bottles of 50. Each tablet contains PARAFLEX, 250 mg.

6

McNEIL

McNeil Laboratories, Inc • Philadelphia 32, Pa.

* U.S. Patent Pending

249A59

Component Societies of the Industrial Medical Association

THE NEW YORK STATE SOCIETY OF INDUSTRIAL MEDICINE, INC.

President: David H. Goldstein, M.D.
Vice-President: Harry E. Tebrock, M.D.
Secretary-Treasurer: Gerald J. Friedman, M.D.
850 Park Avenue, New York 21.

Executive Committee

S. Charles Franco, M.D.
Harold Brandaleone, M.D.
F. P. Guidotti, M.D.
Anthony A. Mira, M.D.
R. J. Murray, M.D.
John Neilson, Jr., M.D.
John J. Poutas, M.D.
Thomas G. Rigney, M.D.
Norbert J. Roberts, M.D.
Willis M. Weeden, M.D.
L. Holland Whitney, M.D.

KANSAS CITY INDUSTRIAL MEDICAL ASSOCIATION

President: James R. McVay Jr. M.D.
President-Elect: Arthur B. Rhoades, M.D.
Secretary: Harold Y. Allen, M.D.
6318 Wornall Rd., Kansas City 13.
Treasurer: William H. Duncan, M.D.
1200 Professional Bldg., Kansas City 6.

Directors

Terry E. Lilly Jr., M.D.
C. G. Leitch, M.D.
James J. Lally, M.D.

MICHIGAN INDUSTRIAL MEDICAL ASSOCIATION

President: Peter B. Rastello, M.D.
President-Elect: Wilfred N. Sisk, M.D.
Vice-President: Duane L. Block, M.D.
Secretary-Treasurer: William Jend, Jr., M.D., Michigan Bell Telephone Co., 1365 Cass Ave., Detroit 26.

Directors

Millard W. Shellman, M.D.
Paul J. Ochsner, M.D.
Earl E. Weston, M.D.

MINNESOTA ACADEMY OF OCCUPATIONAL MEDICINE AND SURGERY

President: T. E. Barber, M.D.
Vice-President: J. A. Williams, M.D.
Secretary: R. W. Goltz, M.D., 825 Nicollet Ave., Minneapolis 2.
Treasurer: B. I. Derauf, M.D.
Recorder: Earl Opstad, M.D.

Executive Committee

Orley Foster, M.D.
James R. Fox, M.D.
John F. Shronts, M.D.

NEW ENGLAND INDUSTRIAL MEDICAL ASSOCIATION

President: Norman White, M.D.
Vice-President: Francis LeBaron, M.D.
Secretary-Treasurer: James I. Roberts, M.D., 441 Stuart Street, Boston 16.

Board of Directors

G. Garfield Defoe, M.D.
John Malloy, M.D.
Harry Mushlin, M.D.
A. Duncan MacDougall, M.D.
William D. Thibodeau, M.D.

CENTRAL STATES SOCIETY OF INDUSTRIAL MEDICINE AND SURGERY

President: Arthur K. Peterson, M.D.
President-Elect: Richard A. Sutter, M.D.
Vice-President: Paul J. Whitaker, M.D.
Secretary-Treasurer: Roland A. Jacobson, M.D.
28 East Jackson Blvd., Chicago 4.

Board of Governors

George J. Cooper, M.D., 1959
E. S. Jones, M.D., 1959
James L. Salomon, M.D., 1959
Allan P. Skoog, M.D., 1959
Eugene L. Walsh, M.D., 1959
Leonard Arling, M.D., 1960
Tracy E. Barber, M.D., 1960
Bille B. Hennan, M.D., 1960
Gordon W. Petersen, M.D., 1960
Richard C. Swan, M.D., 1960
Joseph C. Donchess, M.D., 1961
C. Harlan Johnston, M.D., 1961
G. Prentiss McArdle, M.D., 1961
Harry E. Mock, Jr., M.D., 1961
Paul W. Rush, M.D., 1961

INDUSTRIAL MEDICAL ASSOCIATION OF NEW JERSEY

President: Ralph M. L. Buchanan, M.D.
Vice-President: F. H. DeGrace, M.D.
Secretary: M. R. Vaschak, M.D., E. R. Squibb & Sons, Div. of Olin Mathison Chemical Corp., New Brunswick, N.J.
Treasurer: Thomas F. Nevins, M.D., Esso Standard Oil Co., P.O. Box 222, Linden, N.J.

Directors

George C. Freeman, M.D.
John W. Borino, M.D.
William D. Van Riper, M.D.

NORTHWEST ASSOCIATION OF OCCUPATIONAL MEDICINE

President: Charles M. McGill, M.D.
Vice-President: Forrest E. Rieke, M.D.
Secretary-Treasurer: W. J. Sittner, M.D., 919 Taylor Street Bldg., Suite 410, Portland 5, Ore.
Asst. Secy.: Mrs. Lorna Crosgrove, Swift & Company, North Portland, Ore.

Directors

Eugene P. Owen, M.D., Chairman
B. C. Scudder, M.D.
Sherman M. Williamson, M.D.
Philip A. Fuqua, M.D.
A. John Nelson, M.D.
W. Daggett Norwood, M.D.
I. G. Voth, M.D.
Ralph L. Olsen, M.D.
J. Leon Sealey, M.D.
Ralph R. Sullivan, M.D.

INDUSTRIAL MEDICAL ASSOCIATION OF PHILADELPHIA

President: Allan J. Fleming, M.D.
President-Elect: Walter G. Vernon, M.D.
Secretary: Howard J. Johnson, Jr., M.D.
Corresponding Secretary: C. R. Houchins, Room 1214, Six Penn Center Plaza, Philadelphia 4.
Treasurer: S. F. Brunetti, M.D., 719 Chelter Avenue, Philadelphia 26.

Board of Directors

Howard L. Reed, M.D.
Richard J. Campion, M.D.
F. Curtis Dohan, M.D.
Gilbert B. Meyers, M.D.
Lamson Blaney, M.D.
Thomas H. Hogshead, M.D.
John M. Trapnell, Jr., M.D.

INDUSTRIAL MEDICAL ASSOCIATION OF PITTSBURGH

President: D. John Lauer, M.D.
President-Elect: Daniel V. Dougherty, M.D.
Vice-President: Daniel C. Braun, M.D.
Secretary-Treasurer: Merle Bundy, M.D., United States Steel Corporation, 525 William Penn Place, Pittsburgh 30.

Directors

1957-59
Joseph A. Llewellyn, M.D.
Bernard A. McAleer, M.D.
James L. Thompson, M.D.
Don A. Kelly, M.D.

1958-60
E. V. Henson, M.D.
Warren L. Hogue, Jr., M.D.
Edward M. Kline, M.D.

TERRITORIAL ASSOCIATION OF PLANTATION PHYSICIANS

President: Edward B. Underwood, M.D.
Vice-President: Richard Y. Noda, M.D.
Secretary-Treasurer: Garton E. Wall, M.D., Ewa, Oahu.
Executive Secretary: Mrs. Betty Arnott, 1527 Keeaumoku St., Honolulu, Oahu, T. H.

TEXAS INDUSTRIAL MEDICAL ASSOCIATION

President: W. H. Hamrick, M.D.
President-Elect: Max E. Johnson, M.D.
Vice-President: N. B. Daniel, M.D.
Secretary-Treasurer: Robert A. Wise, M.D., Humble Oil & Refining Company, P. O. Box 2180, Houston, Texas.

Directors

Carl A. Nau, M.D., 1961
V. C. Baird, M.D., 1960
Ervin E. Baden, M.D., 1959
Robert J. Potts, M.D., 1958
W. L. Wilson, M.D., 1958

WESTERN INDUSTRIAL MEDICAL ASSOCIATION

President: Edward J. Zaik, M.D.
Vice-President: Verne G. Ghormley, M.D.
Secretary: A. C. Remington, M.D.; **Assistant Secretary:** Esther Klingsheim, AiResearch Manufacturing Company, 9851 Sepulveda Blvd., Los Angeles 45.
Treasurer: Clarence Lee Lloyd, M.D.; **Assistant Treasurer:** Mrs. Olga Wolf, North American Aviation, Inc., Los Angeles 45.

Board of Directors

David D. Holaday, M.D., Chairman
Vance M. Strange, M.D., 1959
Clark R. Miller, M.D., 1959
C. H. McCallister, M.D., 1960
James P. Warren, M.D., 1960
L. O. Desimone, M.D., 1961
John H. Leimbach, M.D., 1961

WESTERN NEW YORK SOCIETY OF INDUSTRIAL MEDICINE AND SURGERY

President: Joseph T. Andrews, M.D.
President-Elect: James H. McDonough, M.D.
Secretary: George A. Hardie, M.D., Eastman Kodak Co., 343 State St., Rochester 4, N. Y.
Treasurer: Elsa K. Chaffee, M.D., Kodak Park Works, Eastman Kodak Co., Rochester 5, N. Y.

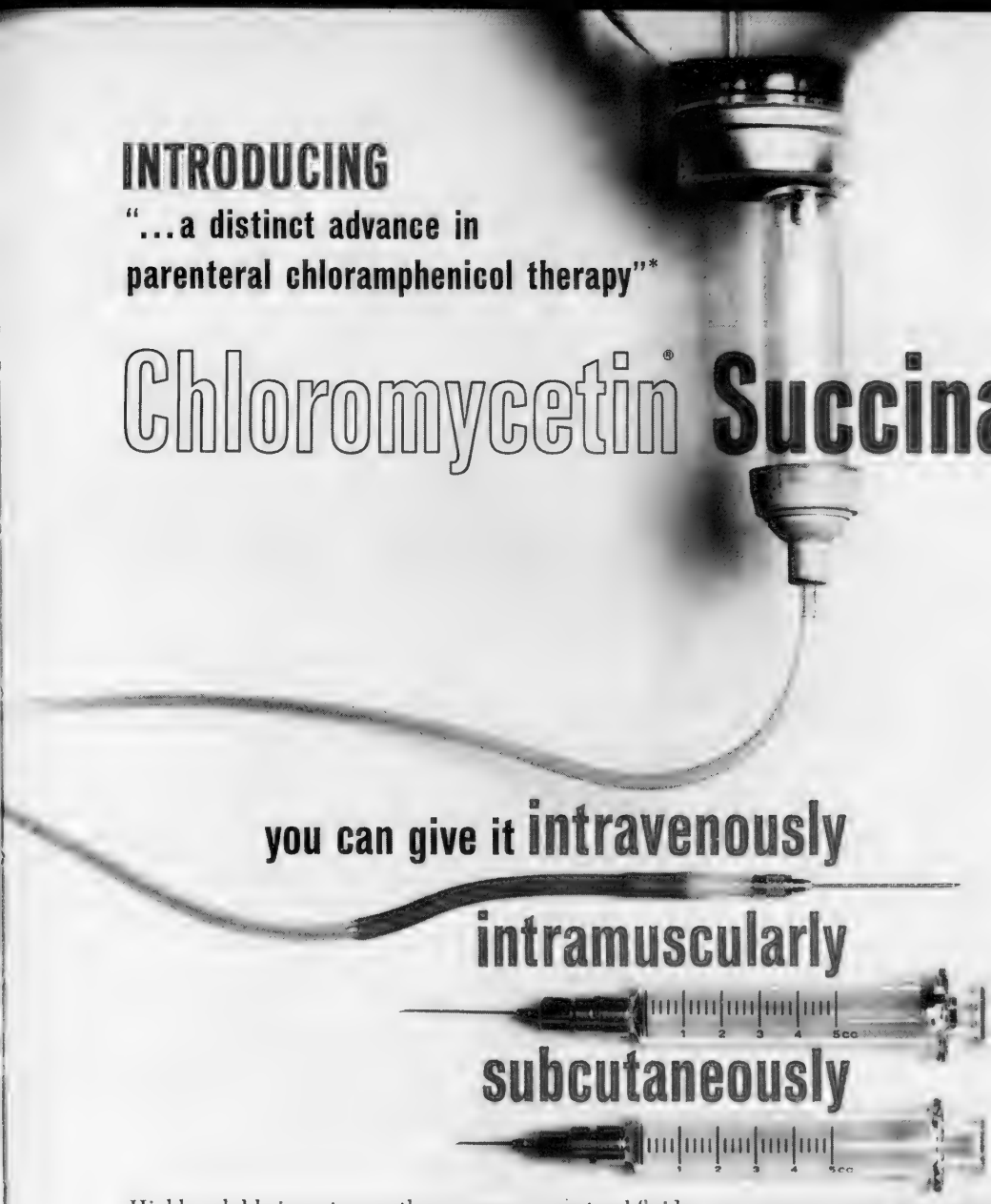
Directors

Joseph C. Klein, M.D., 1961
Robert H. Mehnert, M.D., 1961
Dallas E. Billman, M.D., 1960
Joseph M. Dziob, 1960

INTRODUCING

"...a distinct advance in parenteral chloramphenicol therapy"*

Chloromycetin® Succinate



you can give it intravenously

intramuscularly

subcutaneously

Highly soluble in water or other aqueous parenteral fluids, CHLOROMYCETIN SUCCINATE solution is easily prepared for use by recommended parenteral routes in a wide range of concentrations. Tissue reaction at the site of injection is minimal, permitting continuous daily dosage, even in children.

EXCELLENT CLINICAL RESULTS—CHLOROMYCETIN SUCCINATE provides broad-spectrum antimicrobial effectiveness and may be used whenever CHLOROMYCETIN is indicated. Since effective blood and tissue concentrations of the antibiotic are produced within a short time, clinical response is generally rapid. Signs of irritation at injection sites have been few.

SUPPLY—CHLOROMYCETIN SUCCINATE (chloramphenicol sodium succinate, Parke-Davis) is supplied in Steri-Vials,® each containing the equivalent of 1 Gm. of chloramphenicol; packages of 10.

CHLOROMYCETIN is a potent therapeutic agent and, because certain blood dyscrasias have been associated with its administration, it should not be used indiscriminately, or for minor infections. Furthermore, as with certain other drugs, adequate blood studies should be made when the patient requires prolonged or intermittent therapy.

*Ross, S.; Puig, J. R., & Zaremba, E. A., in Welch, H., & Marti-Ibañez, F.: Antibiotics Annual 1957-1958, New York, Medical Encyclopedia, Inc., 1958, p. 817.

PARKE, DAVIS & COMPANY · DETROIT 32, MICHIGAN

66059

Industrial Medical Association

STANDING COMMITTEES

COMMITTEE ON COMMITTEES
Glenn S. Everts, M.D.*
Curtis Publishing Co.
Philadelphia 5
W. Harvey Cruickshank, M.D.
Allan J. Fleming, M.D.
E. Kern Linder, M.D.
C. Scott McKinley, M.D.

A.S.A. LIAISON
Kenneth C. Peacock, M.D.*
400 Madison Ave.
New York 17
Frank J. Borrelli, M.D.
A. Girard Cranch, M.D.
Robert E. Eckardt, M.D.
Niel E. Eckelberry, M.D.
William P. Eckes, M.D.
John H. Foulger, M.D.

BY-LAWS
H. Glenn Gardiner, M.D.*
Inland Steel Co.
East Chicago, Ind.
Duane L. Block, M.D.
Emmett B. Lamb, M.D.
Arthur K. Peterson, M.D.
George F. Wilkins, M.D.

CARDIOVASCULAR DISEASE
C. Anthony D'Alonzo, M.D.*
E. I. du Pont de Nemours
Wilmington 98, Del.
Paul J. Bamberger, M.D.
Gerald J. Friedman, M.D.
Donald L. Glenn, M.D.
Leonard J. Goldwater, M.D.
Arthur C. Kerkhof, M.D.
Edward M. Kline, M.D.
Lee Miller, M.D.
Alfred W. Pennington, M.D.
John J. Thorpe, M.D.
Harry E. Ungerleider, M.D.

CHEST DISEASES
Harry E. Tebrock, M.D.*
Sylvania Electric Products
1740 Broadway,
New York 19
W. Clark Cooper, M.D.
David T. DuBow, M.D.
Lloyd E. Hamlin, M.D.
O. A. Sander, M.D.
Arthur J. Vorwald, M.D.
Eugene L. Walsh, M.D.

DERMATOLOGY
Raymond R. Suskind, M.D.*
Kettering Laboratory
University of Cincinnati
Cincinnati 19
Donald J. Birmingham, M.D.
William R. Buckley, M.D.
Harold H. Golz, M.D.
Joseph V. Klauder, M.D.
Earl D. Osborne, M.D.
M. Harriss Samitz, M.D.

EDUCATION AND TRAINING
Jean S. Felton, M.D.*
Dept. of Preventive Medicine
and Public Health, University
of California Medical Center
Los Angeles 24
Rodney R. Beard, M.D.
Bernard Behrend, M.D.
John C. Duffy, M.D.
David H. Goldstein, M.D.
Hallett A. Lewis, M.D.
Lemuel C. McGee, M.D.
J. Wister Meigs, M.D.

EMERGENCY AND DISASTER PLANNING
Max N. Howard, M.D.*
Socony Vacuum Oil Co.,
412 Greenpoint Ave.,
Brooklyn 22
Herman J. Bennett, M.D.
John W. Borino, M.D.
Norvin C. Kiefer, M.D.
William N. Young, M.D.

FINANCE
John L. Norris, M.D.*
Kodak Park Works,
Eastman Kodak Co.,
Rochester 4
Allan J. Fleming, M.D.
J. F. McCahan, M.D.

GERIATRICS AND RETIREMENT
Russell B. Robson, M.D.*
1309 Windermere Road
Walkerville, Ont., Canada
Henry S. Brown, M.D.
W. A. Dawson, M.D.
Charles E. Dutchess, M.D.
Milton H. Kronenberg, M.D.
Will F. Lyon, M.D.
William A. Sawyer, M.D.
McIver Woody, M.D.

GROUP INSURANCE
George J. Cooper, M.D.*
10 S. LaSalle St., Chicago 3
Richard J. Bennett, M.D.
Clark D. Bridges
Bryce B. Reeve, M.D.
James L. Salomon, M.D.

HEALTH ACHIEVEMENT IN INDUSTRY AWARD
Richard A. Sutter, M.D.*
915 S. Olive St., St. Louis 1
Joe M. Bosworth, M.D.
L. E. Hamlin, M.D.
Rutherford T. Johnstone, M.D.
O. Tod Mallery, Jr., M.D.

HISTORY
Alfred H. Whittaker, M.D.*
1427 E. Jefferson, Detroit 7
David H. Goldstein, M.D.
Robert T. Legge, M.D.
James I. Roberts, M.D.
McIver Woody, M.D.

KNUDSEN AWARD
Robert A. Kehoe, M.D.*
Kettering Laboratory
University of Cincinnati
Cincinnati 19
Kieffer D. Davis, M.D.
E. A. Irvin, M.D.

MEDICAL CARE AND PRACTICE
Asa Barnes, M.D.*
U.M.W. Welfare and
Retirement Fund
310 W. Liberty St.
Louisville 2
Herbert K. Abrams, M.D.
Charles W. Asbury, M.D.
Preston N. Barton, M.D.
Donald Cass, M.D.
Louis J. Cella, Jr., M.D.
John H. Ganschow, M.D.
Frank P. Guidotti, M.D.
Bernard A. McAleer, M.D.
Edward A. Miller, M.D.
Anthony A. Mira, M.D.

MEDICAL CARE AND PRACTICE—*Continued*
Leo Price, M.D.
Logan T. Robertson, M.D.
William A. Sawyer, M.D.

MEMBERSHIP
Bryce B. Reeve, M.D.*
Standard Oil Co. (Ind.)
910 S. Michigan Ave.,
Chicago 80
Allan K. Harcourt, M.D.
George H. McDonald, M.D.
Otto J. Preston, M.D.
Charles F. Shook, M.D.

MENTAL HEALTH
D. W. Caldwell, M.D.*
Esso Research & Eng. Co.
P.O. Box 51, Linden, N. J.
Ralph T. Collins, M.D.
Gordon A. Eadie, M.D.
Leonard E. Himler, M.D.
William Lee, M.D.
John M. Lynch, M.D.
Joseph C. Placak Jr., M.D.
Lawrence A. Pyle, M.D.

MERIT IN AUTHORSHIP AWARD
William F. Ashe, M.D.*
Medical Center,
Ohio State University,
Columbus 10
Maurice P. Charnock, M.D.
Jean S. Felton, M.D.
Walter E. Fleischer, M.D.
David H. Goldstein, M.D.
Ralph F. Schneider, M.D.

MERITORIOUS SERVICE AWARD
J. H. Wolfsie, M.D.*
American Cyanamid Co.,
P.O. Box 31, Linden, N. J.
R. Emmet Kelly, M.D.
Arthur F. Mangelsdorff, M.D.
John F. Shronts, M.D.
Richard C. Swan, M.D.

PROBLEM DRINKING
John F. Jellema, M.D.*
Fisher Body Plant No. 2
2060 Voorheis Ave., N.W.
Grand Rapids, Mich.
D. C. Bews, M.D.
Edward F. Buyniski, M.D.
Thomas H. Hogshead, M.D.
Raymond A. Mezera, M.D.
James I. Roberts, M.D.
John F. Shronts, M.D.

PUBLIC RELATIONS
Thomas G. Rigney, M.D.*
Standard Oil Co. (N. J.)
30 Rockefeller Plaza
New York 20
Reeve M. Brown, M.D.
David H. Goldstein, M.D.
Lemuel C. McGee, M.D.
Wilfred N. Sisk, M.D.

PUBLICATIONS AND EDITORIAL
Ronald F. Buchan, M.D.*
Prudential Insurance Co.
142 Berkeley St.,
Boston 17
Clark D. Bridges
Harriet L. Hardy, M.D.
Hallett A. Lewis, M.D.
Frank Princi, M.D.

RADIATION
W. D. Norwood, M.D.*
General Electric Co., 1005
Guthrie, Richland, Wash.
Joseph A. Quigley, M.D.
Thomas L. Shipman, M.D.
Albert A. Spritzer, M.D.
W. L. Sutton, M.D.
Irving R. Tabershaw, M.D.
Mitchell R. Zavon, M.D.

SMALL PLANT SERVICES
Logan T. Robertson, M.D.*
P.O. Box 2509,
Asheville, N. C.
Joe M. Bosworth, M.D.
Bert W. Brooks, M.D.
William W. Dickinson, M.D.
Harry Lamb, M.D.
James H. McDonough, M.D.
William G. Thuss Jr., M.D.

STANDARDS
James P. Hughes, M.D.*
Kaiser Aluminum & Chem. Corp.
1924 Broadway,
Oakland 12, Calif.
Daniel C. Braun, M.D.
Carl U. Dernehl, M.D.
Clark R. Miller, M.D.
Edwin A. Turcot, M.D.
Charles E. Work, M.D.

STANDARDS FOR VEHICLE DRIVING
Harold Brandaleone, M.D.*
116 East 63rd St.
New York 21
Lamson Blaney, M.D.
Gerald J. Friedman, M.D.
G. H. Irwin, M.D.
Hedwig S. Kuhn, M.D.
Seward E. Miller, M.D.
Melvin N. Newquist, M.D.
Rafael Penalver, M.D.
Forrest E. Rieke, M.D.
Robert P. Sim, M.D.

SURGERY OF TRAUMA
Harold I. Meyer, M.D.*
Illinois Bell Telephone Co.
212 W. Washington,
Chicago 6
Richard J. Bennett, M.D.
James J. Callahan, M.D.
Chester C. Guy, M.D.

TOXICOLOGY
Frank Princi, M.D.*
Kettering Laboratory,
University of Cincinnati,
Cincinnati 19
Elston L. Belknap, M.D.
Harriet L. Hardy, M.D.
Ralph W. Haswell, M.D.
Rutherford T. Johnstone, M.D.
Thomas F. Mancuso, M.D.
Rex H. Wilson, M.D.
Jack H. Wolfsie, M.D.

WORKMEN'S COMPENSATION
E. J. Showalter, M.D.*
Western Electric Company
195 Broadway, New York 7
Thornton I. Boileau, M.D.
J. V. Donaldson, M.D.
N. Gillmor Long, M.D.
Carl T. Olson, M.D.
E. C. Steele, M.D.
W. G. Thuss Sr., M.D.
John L. Tyler, M.D.
Willis M. Weeden, M.D.

*Committee chairmen are designated by asterisks.

ANNUAL MEETING & INDUSTRIAL HEALTH CONFERENCE
Sherman Hotel, Chicago — April 28, 29, 30, 1959

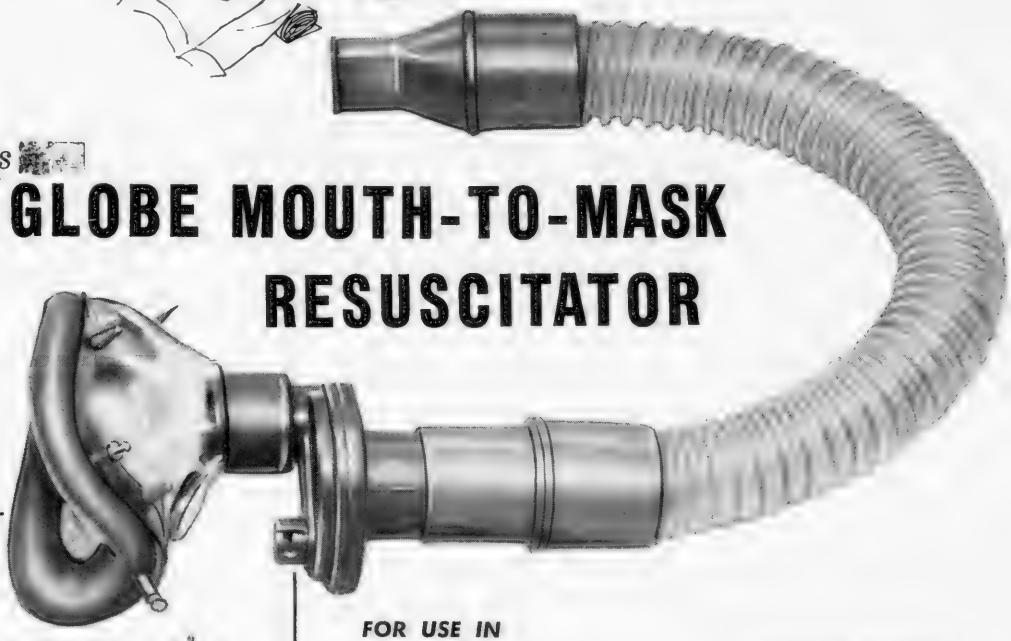
KAREL

FIRST AID SUPPLY COMPANY

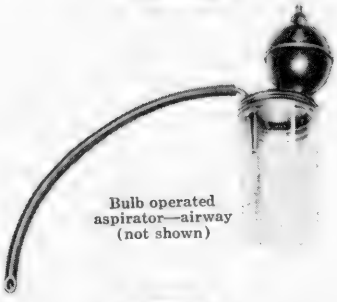
For over 29 years leaders in industrial medical supplies and equipment

proudly introduces the new

GLOBE MOUTH-TO-MASK RESUSCITATOR



Globe M/M Mouth-to-Mask Resuscitator



Bulb operated aspirator—airway (not shown)

Accessible zipper carrying case

FOR USE IN

- Shock
- Smoke and toxic gas inhalation
- Crushed chest or sucking chest injuries
- Swimming accidents
- Asthmatic attacks
- Any case of impaired or arrested breathing needing quick first aid

You get all of the already approved benefits of mouth-to-mouth resuscitation[1] plus the important advantages of being separated from the victim.

1. J.A.M.A. 167:317-341, May 17, 1958.

SAFE—For adult or child—under any conditions
—Automatic valve limits applied pressure
—Rebreathing feature prevents hyperventilation
—Operator can't inhale patient's breath

EFFICIENT—1000 ml. air exchange each breath
—Air reaching alveoli has O_2 content of room air
—Mask construction insures tight seal
—Allows sight of patient's face, lips, chest

EASY—Eliminates strenuous manipulation of patient
—Just seconds to learn correct operation
—Operator maintains comfortable stance
—Completely portable—kit weighs just 2 lbs.

Kit includes M/M resuscitator, face mask, air-way, and bulb operated aspirator packed in handy zipper bag.....Price **$34.50**

Manufactured by
GLOBE INDUSTRIES, INC.
Dayton 7, Ohio

Distributed by

Karel **First Aid Supply Company**

4342 OGDEN AVE. CHICAGO 23, ILL.

Association Activities

Industrial Health Conference Organization and Planning Committees

The infinite planning and arranging necessary to make the Industrial Health Conference a smooth running operation is done by the many committees of each of the five participating organizations. D. JOHN LAUER, M.D., is Chairman of the Conference, and H. T. WALWORTH is Deputy Chairman. The chairman of each committee is shown in the following list.

Industrial Medical Association: conference chairman—A. K. PETERSON, M.D.; program chairman—EUGENE L. WALSH, M.D.; publicity chairman—JAMES L. SALOMON, M.D.; scientific exhibits chairman—PAUL J. WHITAKER, M.D.; arrangements chairman—N. GILLMOR LONG, M.D.; banquet chairman—ROLAND A. JACOBSON, M.D.; entertainment chairman—MRS. E. B. LAMB.

American Industrial Hygiene Association: conference chairman—LLOYD GORDON; program chairman—ELMER P. WHEELER; publicity chairman—HERBERT J. WEBER; scientific exhibits chairman—D. P. O'NEIL; arrangements chairman—GEORGE P. BITTNER; banquet chairman—J. T. SIEDLECKI; entertainment chairman—W. T. MCCORMICK.

American Conference of Governmental Industrial Hygienists: conference chairman—WARREN R. REINHART; program chairman—MIRIAM SACHS, M.D.; publicity chairman—TULA S. BROCARD; scientific exhibits chairman—W. E. PARK, M.D.; arrangements chairman—DOROTHY GEISHECKER.

American Association of Industrial Nurses: conference chairman—MARIE GROVEN, R.N.; conference co-chairman—ALIDA VAN DEN BERG, R.N.; program chairman—ETHEL C. BURGESON, R.N.; publicity chairman—JULIA A. KLOOSTER, R.N.; scientific exhibits chairman—FELICIA P. HANES, R.N.; arrangements chairman—MARY KAY MILLEA, R.N.; banquet chairman—GERTRUDE GRASS, R.N.; entertainment chairman—NELL SEITZ, R.N.

American Association of Industrial Dentists: conference chairman—K. W. MISHER, D.D.S.; program chairman—GUY C. KIRBY, D.D.S.; publicity chairman—L. S. MORVAY, D.D.S.; scientific exhibits chairman—HARRY H. DOUGHERTY, D.D.S.; arrangements chairman—R. I. HUMPHREY, D.D.S.; banquet chairman—CALVIN WEISS, D.D.S.; entertainment chairman—ROBERT NEMEROFF.

Occupational Medicine Examinations Scheduled

Examinations for specialty certification in occupational medicine will be conducted by the American Board of Preventive Medicine preceding the Industrial Health Conference in Chicago. The written examinations will be given April 24 and 25 in the Louis XVI room at the Sherman Hotel. The oral examinations will be given on April 26.

Academy Dinner

The American Academy of Occupational Medicine dinner, annually held at the time of the Industrial Health Conference, will be Tuesday, April 28 in the Crystal Room of the Sherman Hotel in Chicago.

IMA Organizational Meetings—Industrial Health Conference

Meeting	Day	Date	Time	Place	Presiding Officer
Executive Committee	Saturday	April 25	2:00 P.M.	Dr. Lawrence's suite	Dr. Lawrence
District Counselors	Sunday	April 26	2:00 P.M.	Gold Room #114	Dr. Rowntree
Committee Chairmen	Monday	April 27	9:00 A.M.	Gold Room #114	Dr. Lawrence
Committee on Mental Health	Monday	April 27	4:00 P.M.	Dr. Holmblad's suite	Dr. Caldwell
Component Society Officers	Tuesday	April 28	9:00 A.M.	Gold Room #114	Dr. Eckardt
Committee on Standards for Motor Vehicle Driving	Tuesday	April 28	9:30 A.M.	Polo Room #102	Dr. Brandaleone
Organizational Meeting (Proposed National Woman's Auxiliary to IMA)	Tuesday	April 28	2:00 P.M.	Parlors M & O	Mrs. Lamb
Board of Directors	Tuesday	April 28	4:00 P.M.	Gold Room #114	Dr. Lawrence
Journal of Occupational Medicine					
Editorial Board	Wednesday	April 29	9:00 A.M.	Time Room #110	Dr. Kammer
Literature Abstracters	Wednesday	April 29	12:00 noon	Time Room #110	Dr. Kammer
Committee on Medical Care	Wednesday	April 29	12:00 noon	Holiday Room #105	Dr. Barnes
Annual Business Meeting	Wednesday	April 29	3:30 P.M.	Grand Ball Room	Dr. Lawrence
General Reception	Wednesday	April 29	6:00 P.M.	Grand Ball Room	
Annual Banquet	Wednesday	April 29	7:00 P.M.	Grand Ball Room	Dr. Lawrence
Orientation (New Officers, Directors, Committee Chairmen and Counselors)	Thursday	April 30	9:00 A.M.	Gold Room #114	Dr. Lauer
Past President's Luncheon	Thursday	April 30	12:00 noon	Holiday Room #105	
OHI Board Meeting	Thursday	April 30	2:00 P.M.	Life Room #108	
Planning Meeting for 1960 Conference	Friday	May 1	8:00 A.M.	Gold Room #114	Mr. Walworth
Executive Committee	Friday	May 1	12:15 P.M.	Dr. Lawrence's suite	Dr. Lauer

for
season-long
immunity
to
poison ivy
or
poison oak

keep them on the job with AQUA IVY, AP

alum precipitated pyridine-ivy extract suspended in saline solution

Good to excellent results — up to 93% of cases.[1-6]

". . . superior to either alcohol/ether or the oil resorption materials because of the ease of its administration, its concentrated dosage, and its more effective clinical results along with lessened possibility of exacerbations of symptoms. The alum precipitated material is slowly absorbed".[2]

Non-toxic — non-irritating
". . . even when administered to children . . .".[3]

HOW SUPPLIED In a combination package containing one 5 cc. vial of a 1:50 dilution (0.3 mg./cc.) and one 10 cc. vial of a 1:5 dilution (3.0 mg./cc.) (administration sufficient for at least 3 patients).

REFERENCES

1. Gaillard, G. E.: New York J. Med. 56:14, 1956.
2. Passenger, R. E., Spain, W. C. and Strauss, M. B.: J. Allergy 27: 409-423, 1956.
3. Fontana, V. J.: GP 10:47, 1954.
4. Gaillard, G. E.: J. Allergy 21:55, 1950.
5. Strauss, M. B. and Spain, W. C.: J. Allergy 17: 1-10, 1946.
6. Neidorff, H. A.: Personal Communication.

Also available as AQUA IVY, AP® TABLETS for oral prophylaxis in bottles of 100 tablets of 0.6 mg. each. Each tablet contains 0.6 mg. dry alum precipitated pyridine-ivy.

Literature on request — WRITE TO DEPT. J1

10 East 40th Street, New York 16, N. Y.

PLAN NOW

to attend the

1959 INDUSTRIAL HEALTH CONFERENCE

Sherman Hotel — Chicago

April 25 to May 1

Annual Meeting and Convention of

American Conference of Governmental Industrial Hygienists

April 25-28

American Industrial Hygiene Association

April 27-May 1

American Association of Industrial Dentists

April 27-29

American Association of Industrial Nurses

April 28-30

Industrial Medical Association

April 28-30

Technical and Scientific Sessions

Scientific Exhibits

Technical Exhibits

Journal of Occupational Medicine

Radiation as an Industrial Medical Problem

Charles M. Dunham, M.D., Washington, D.C.

RADIATION was an industrial health problem long before nuclear reactors and atomic bombs became a reality. So it is not exactly accurate to equate the coming of atomic energy with the introduction of radiation as an industrial health problem. It is true, of course, that only with the successful development of the nuclear reactor did the available sources of radioactivity cease to be a few curies worth and grow quickly to millions of curies. This is the reason why the radiation hazards of the nuclear age are potentially greater by orders of magnitude than in prior years and why Dr. Detlen W. Bronk, in his foreword to the 1956 NAS-NRC Summary Report "The Biological Hazards of Atomic Radiation" was justified in saying:

> The use of atomic energy is perhaps one of the few major technological developments of the past 50 years in which careful consideration of the relationship of a new technology to the needs and welfare of human beings has kept pace with its development. Almost from the very beginning of the days of the Manhattan Project careful attention has been given to the biological and medical aspects of the subject. By contrast, the automobile revolutionized our pattern of living and working, but we are only now beginning to appreciate the problems of safety, urban congestion, nervous tension, and atmospheric pollution which have accompanied its development.

Since the successful achievement of the release of nuclear energy there have been a number of persons accidentally overexposed to radiation in our atomic energy program, and two deaths are directly attributed to accidents involving radiation. Still, compared with the first large-scale uses of lead, beryllium, and aniline in industry, the record is remarkably good.

The most characteristic feature of radiation as a day-to-day industrial health problem is the long latent period which elapses between exposure or beginning exposure and the first appearance of clinical or laboratory evidence of injury. In general, the lower the exposure or the exposure rate the later the resulting injury manifests itself. Usually, years intervene before malignant change appears. Any genetic effects would appear in succeeding generations and probably be demonstrable only on a statistical basis. Acute injuries have occurred and will be a continuing threat so long as nuclear energy continues to be exploited for the benefit of society or as a weapon of war.[1-5] Industrial physicians must learn how to deal with such eventualities, but in their day-to-day contact with radiation problems they will be concerned more with the prevention of over exposure to radiation and the care of the less dramatic injuries involving radiation, such as localized skin burns and wounds contaminated with radioactive materials.

Awareness that ionizing radiation was dangerous developed quite early. It is related that in 1896 a volunteer assistant of Professor Pupin at Columbia University noted erythema, itching, and desquamation of the skin of his hand following exposure to x-rays.[6] The first knowledge of the carcinogenic action of radiation exposure appeared in 1902, only seven

Dr. Dunham is Director, Division of Biology and Medicine, United States Atomic Energy Commission.

years after x-rays were discovered. Ionizing radiations in very large total doses, probably of the order of several thousand roentgens to the skin, were observed to have caused skin cancer. During the next two decades cases of radiation-induced skin cancer among physicists and radiologists appeared and were related to exposures incurred during their work as scientists, but it was not until the middle 20's that radiation was clearly established as an industrial health hazard in the usual sense of the word.

Although sporadic cases of radiation dermatitis and skin cancer had been clearly related to heavy local radiation exposure, the use of ionizing radiation to diagnose and to treat disease was not considered to be a hazard warranting the continued attenion of public health officers. In 1935, however, Martland[3] reported an outbreak of cases of osteitis, anemia, and bone cancer in young women, all employed in the watch dial industry in New Jersey. This study has become a classic in what we might now call radioepidemiology. Meanwhile it was known that in Czechoslovakia in the pitchblende mines, which had been worked for centuries for a variety of minerals, death from pulmonary disease was the rule. By 1913 it was established that a prime cause of death in these workers was lung cancer, and in 1942 it was established that the atmosphere of the mines contained considerable concentrations of radon gas, probably great enough to be the causative agent for the lung cancers.[8]

In 1927 Muller[9] established the fact that roentgen irradiation of the germ cells of the fruit fly resulted in gene mutations. Since then, the mutagenic effects of ionizing radiations have been repeatedly demonstrated by a number of workers in a variety of organisms including the mouse. Similarly, in the 1930's it was established that whole body irradiation in single or divided doses was leukemogenic in mice.[10] So by 1940, except for the effects of whole-body radiation exposure on average life span, the general nature of the hazards inherent in working with radiation and radiation sources was known although poorly quantitated.

Beginning in 1929 a group which later became the National Committee on Radiation Protection and Measurement began cooperating with the International Commission on Radiological Protection in developing recommendations concerning the maximum permissible exposure of the relatively few adult workers who were then using x-ray machines and radium and, later, other sources of ionizing radiation. The recommendations were based on scientific facts obtained both experimentally in the laboratory and by observation of injuries incurred by persons in radiology and radiological physics and in the luminous dial industry. Until 1934 the levels recommended were of the order of 100 rem per year. In 1935 the National Committee on Radiation Protection recommended 30 rem per year or 0.1 rem per day[11] [Subsequently, as more quantitative data on the late effects of radiation accumulated these recommendations have been revised. In 1950 the recommendation was 0.3 r per week or 15 r per year, and in 1957 the average annual permissible exposure was set at 5 r.]

It is interesting to see how the picture looked at the time to those responsible for the health of the workers on the atomic bomb project[12]:

Early in 1942 the scientists of the Metallurgical Laboratory became convinced that a nuclear chain-reacting pile could be built. They realized the enormity of the health hazards that such a unit would create. Some of them had friends or acquaintances who had been injured in experimental work with x-rays or with radium, and many were aware of the harmful effects suffered by some of the workers in the radium-dial industry.

The exact nature and extent of the hazards to be encountered were not known. In general, it was realized that the pile in which the chain reaction would take place could be a far greater source of fast and slow neutrons and gamma rays than could have been dreamed possible in earlier periods. It was estimated that the pieces of uranium that would have to be removed from the pile after fission had occurred would contain materials far more radioactive than any that had been encountered in the radium industry. It appeared certain that not only the uranium but also any other material that would be removed from such a pile would be extremely active in producing alpha, beta or gamma rays. The chemical process of separating the plutonium from the other extremely radioactive elements was recognized as another tremendously hazardous procedure. The effect that plutonium itself might have on the workers was unknown.

* * * * *

Since no one person could have all the required knowledge or could know how to acquire it, a health group was formed which gradually evolved into an organized Health Division. The objectives of the Health Division as stated by the Laboratory Director were as follows:

1. Protection of the health of the workers on the project.
2. Protection of the public from any hazards arising from the operation of the project.
3. A study of the peculiar hazards for the purpose of being better able to establish tolerance doses, to predict more accurately what might happen in the future, to devise means of detecting ill effects to personnel, and to discover methods of treating any person who might be injured.

Dr. Robert S. Stone wrote the above. He, Dr. Stafford Warren, and Dr. Hymer Friedell were principally responsible for the medical program of the Manhattan Engineering District, wartime atomic bomb project. They enlisted the services of the best radiological physicists and industrial hygiene specialists then available in developing an extraordinary pro-

gram of radiation protection for the workers on the project. Furthermore, they sensed the need for much more information on the biological effects of ionizing radiation and initiated a broadly conceived research program for that purpose. This program drew on the talents of many university scientists and scientists in the government, notably from the National Cancer Institute and the National Bureau of Standards. It clearly defined the syndrome of whole-body radiation injury before it was observed in Japan in 1945 and initiated experimental studies in mice on the genetic effects of radiation, the effects of radiation on life span, and the carcinogenic action of internally deposited radioactive materials. The actual scope of the health service activities by the spring of 1944 have been summarized as follows[13]:

1. Health-service activities.
   a. Surveys of the skin for contamination with radioactive materials.
   b. Surveys of the laboratories for various types of radioactive contaminants.
   c. Metering of personnel with various types of pocket ionization chambers and film meters to determine individual exposures.
   d. Surveys of atmosphere for radioactivity.
   e. Surveys of effluent water from the Clinton pile area to determine contamination. Methods developed here will be useful at Hanford.
   f. Examinations of body secretions and excretions for radioactive materials.
   g. Clinical laboratory examinations for various types of damages to personnel exposed to either tolerance or larger doses of radiation.

This statement needs no change today as a guide to those responsible for the health of the workers and of the public in an industrial plant handling radioactive materials.

In the late 40's and early 50's more and more experimental work was done, sufficient to suggest a hypothesis that radiation levels only a little above natural background radiation or even background radiation itself have genetic effects on populations and may even be responsible for some cases of bone cancer and leukemia among the so-called normal incidence of these conditions. In June, 1956, the National Academy of Sciences and the British Medical Research Council published reports on the biological effects of radiation. These reports were stimulated by concern over the possible harmful effects of radiation from fallout from the testing of atomic weapons. Both reports concluded that any radiation exposure might exact a biological cost at least from the genetic standpoint. The reports went further and suggested that except for exposure from natural radioactivity the largest single factor in exposure to the population as a whole was medical x-rays. This has led to active efforts to reduce body and gonadal exposures from diagnostic and therapeutic x-rays. A byproduct of this concern with radiation as a health hazard was the formation in 1957 by the Department of Health, Education and Welfare of a special committee to advise the Surgeon General of the Public Health Service on radiation health matters. Thus, not only the Atomic Energy Commission, which because of its statutory responsibilities has from its inception been preoccupied with radiation health problems in its operations and since the Atomic Energy Act of 1954 in its licensing program, but other national, state, and local health agencies and such bodies as the American Standards Association have become increasingly concerned with radiation hazards. This means that each industrial medicine program in a plant which uses radiation sources of any type, even if it includes only the diagnostic x-ray machine in the plant medical office, must be cognizant of radiation as an industrial health problem. It behooves each industrial physician to become conversant with radiation medicine, the treatment of radiation accidents, and the methods of controlling radiation exposures generally, as well as to gain a more detailed knowledge concerning the particular radiation sources being used in the plant or plants for which he has the medical responsibility.

There are too many variations in the amount and kinds of radioactive material handled for any set rules to be established. Each plant will have its own special problems. In AEC operations there are nearly as many different organizational approaches to the problem as there are plants and laboratories. In many instances shortages of experts of one type or another in the various specialties have led to compromise and to placing the major share of the responsibility for radiation health protection on the man most competent to bear it, whether a physician, a radiological or health physicist, or an industrial hygiene engineer. In some instances this person reports directly to top management, in others through a medical director. The important thing is that the responsibility is clearly assigned to someone who understands radiation protection problems. The medical director must keep close contact with the program, even if he does not administer it. He must have full understanding of the types of accidents which could arise and be prepared to handle radiation injuries quickly and competently.

There is a further responsibility which the physician, or medical director, must undertake; namely, education of personnel. There is so much talk today of the hazards of radiation

that lay persons frequently become unnecessarily apprehensive about them. Considerable numbers of persons are refusing to submit to important diagnostic x-ray procedures because of something they have read or heard on the radio or television. Workers who have developed confidence in those responsible for radiation protection at the plant are suddenly worried about added exposure from a routine chest x-ray film. The worker who develops a cancer of any sort may become the prey of lawyers who would claim a fee for supporting him in a suit claiming radiation exposure as the cause of his disease. Unfortunately, except for a severe radiation burn, the chronic sequelae of which are readily recognized, none of the delayed effects of radiation is in any way specific to radiation. A radiation-induced leukemia is not identifiable as such. Nor can a radiation-induced cancer be identified any more than one induced by cigarettes. A radiation-induced mutation has no tag on it telling us that it was caused by radiation. This means that one has to speak and think of these things in terms of probability. This is a difficult concept for the layman to grasp. His experience and his habits of thought with respect to injury involve readily identifiable specific cause and specific effect relationships. Further, it is important to recognize that it is only a limited number of disease states which may be related even statistically to chronic low-level radiation exposure. Most diseases cannot be so related. The worker first turns for guidance on these matters to the industrial physician and to the family physician, who must be prepared to discuss the problem with him in simple understanding terms. The American College of Radiology has developed a very useful pamphlet which should be read by every industrial physician.[14] It can do much to place the hazards inherent in diagnostic x-ray exposure in proper perspective.

In 1949 and 1950 the AEC established special fellowships in industrial medicine, radiological physics and industrial hygiene in order to meet the needs of its operations and to provide persons trained in radiological health matters for the expanding atomic energy industry and industrial users of radioactive materials under AEC license. Meanwhile, the U. S. Public Health Service has established short courses in radiation health problems for health officers. Recently symposia on radiation problems have been sponsored by some state and other medical societies. These symposia are extremely useful in keeping the medical profession as a whole up to date on the problem. For a number of years the Industrial Medical Association and the American Industrial Hygiene Association have devoted whole sessions at their annual meetings to the health problems of the atomic age. It is to be hoped that more and more industrial physicians will take advantage of these opportunities to learn about radiation hazards, the methods for their control, and the therapy of injuries incurred in accidents involving radiation and radioactive materials.

Whether the future holds peace or war the number and the magnitude of sources of ionizing radiation will continue to increase and to require increasingly the attention of the industrial physician. Fortunately, on the basis of the record to date, radiation as a health problem in industry can be dealt with just as effectively as any of the other industrial hazards.

Dr. Dunham's address is U.S. Atomic Energy Commission, Germantown, Md.

References

1. Oughterson, A. W., and Warren, S.: Medical Effects of the Atomic Bomb in Japan, National Nuclear Energy Series, Vol. VIII-8, New York, McGraw-Hill Book Company, Inc., 1956, p. 105.

2. Knowlton, N. P.; Leiber, E.; Hogness, J. R.; Hempelmann, L. H.; Blaney, L. F.; Gill, D. C.; Oakes, W. R., and Shafer, C. L.: Beta Ray Burns of Human Skin, *J.A.M.A.* 141:239, 1949.

3. Hempelmann, L. H.; Lisco, H., and Hoffman, J. G.: The Acute Radiation Syndrome: A Study of 9 Cases and a Review of the Problem, *Ann. Int. Med.* 26:279, 1952.

4. Hasterlik, R. J.: Clinical Report of 4 Individuals Accidentally Exposed in Gamma Radiation and Neutrons, Report ANL-4971, McCook, Ill., Argonne National Laboratory, Jan., 1953.

5. Union Carbide Nuclear Company: Accidental Radiation Excursion at the Y-12 Plant, Report Y-1234, Oak Ridge, Tenn., June 16, 1958.

6. Behrens, C. F.: Atomic Medicine, Baltimore, Williams & Wilkins Company, 1953.

7. Martland, H. S.; Colon, P., and Knef, J. D.: Some Unrecognized Dangers in the Use of the Handling of Radioactive Substance, with Special Reference to the Storage of Insoluble Products of Radium and Mesothorium in the Reticulo-Endothelial System, *J.A.M.A.*, 85:1769, 1925.

8. Rajewsky, B. A.; Schraub, A., and Schraub, E.: Über die toxische Dosis bei Einatmung von Ra-Emanation, *Naturwissenschaften* 30:489, 1942.

9. Muller, H. J.: Artificial Transmutation of the Gene, *Science* 66:84, 1927.

10. Furth, J., and Furth, O .B.: Neoplastic Diseases Produced in Mice by General Irradiation with X-Rays: Incidence and Types of Neoplasms, *Am. J. Cancer* 28: 54, 1936.

11. Taylor, L. S.: Radiation Exposure as a Reasonable Calculated Risk, *Health Physics* 1:62, 1958.

12. Stone, R. S.: Industrial Medicine on the Plutonium Project, National Nuclear Energy Series, Vol. IV-20, New York, McGraw Hill Book Company, Inc., 1951, pp. 1-2.

13. Stone,[12] p. 8.

14. A Practical Manual on the Medical and Dental Uses of X-Rays with Control of Radiation Hazards, Chicago, American College of Radiology, 1958.

A Comparison of Railroad and Steel Mill Lost Time Cases

Robert J. Halen, M.D., Pittsburgh

THE MOST commonly employed measurements of industrial safety performance involve evaluation of personal injuries sustained as a result of industrial accidents. The frequency rate is a function of the number of disabling injuries (lost time cases) per unit of work force, and the severity rate is a function of the days lost from work as a result of these injuries, with a suitable constant in both instances. In the case of fatalities and amputations, a prescribed number of days, determined by the American Standards Association, is utilized in compiling these rates. Except in these two categories, which fortunately are a small fraction of the total lost time cases, no such objective values are assigned to injuries. A fracture may in one instance be a lost time case; a similar fracture in another instance may not be a lost time case. If safety performance is to be measured by the employee's injuries, measurement of this performance would more logically end with occurrence of the fracture. Subsequent events which determine the duration of absence from work are the result of a complex interaction of forces which have little bearing on safety performance.

The two industrial accident experiences which will be described illustrate, and perhaps caricature, mistaken impressions of industrial safety situations which might be obtained if one were to consider only frequency and severity rates.

Material

The lost time cases for one year in an integrated steel mill and an industrial switching railroad will be considered. The year was chosen at random and is the same year for both the steel mill and the railroad. Steel mill facilities include coke ovens, blast furnaces, open hearth furnaces, foundries, rolling mills, and others. The railroad is a diesel-powered switching road serving the above steel mill. It maintains its own equipment and track and connects with trunk line railroads in yards adjacent to the steel mill property. Table I records pertinent data relative to safety performance.

The railroad frequency rate is approximately 14 times that of the steel mill. The severity rate is almost twice that of the steel mill. The "new case" category represents the total number of new injury cases reporting to the dispensary during the year. One of every 258 new mill cases is a lost time case. One of every 10 new railroad cases is a lost time case.

Table II represents an attempt to describe these lost time cases more accurately. The categories of injuries are listed in an approximate order of severity of trauma.

Obviously, certain cases in one category may represent more serious injury than certain cases in a higher category. The general assumption is made that continuation or extension of forces causing contusions and sprains will result in fracture. Contusions are placed higher on the scale than sprains because patient susceptibility is less a factor. The same reasoning with respect to susceptibility and the difficulty

Table I—A Comparison of Steel Mill and Railroad Safety and Medical Data

	Steel	Rail
Man hours worked	21,956,585	2,029,217
Number lost time cases	53	69
Frequency lost time cases	2.41	34.0
Total days lost	15,500*	2,637
Severity rate	706	1,300
New cases	13,702	698

Frequency equals number lost time cases times 1,000,000/man hours worked.

Severity equals total days lost times 1,000,000/man hours worked.

*Includes 12,000 days for two fatalities.

Dr. Halen is Works Physician, Pittsburgh Works Division, Jones and Laughlin Steel Corporation.

Table II—Steel Mill and Railroad Lost Time Cases Tabulated by Type of Injury

	Steel		Rail	
Amputations	7		1	
Fractures	23	81%	8	22%
Burns	8		2	
Lacerations	6		4	
Contusions	4		14	
Sprains	2	13%	22	72%
Back	1		15	
Miscellaneous	2*		3†	
Total	53			69

*Alkali burns of the eye, 2.
†Post-traumatic syndrome, 2; inguinal hernia, 1.

in ascribing a proper value to trauma places back cases at the bottom of the scale. This is not considered a precise classification but only an expedient for this discussion.

The more objective groupings—amputations, fractures, burns, and lacerations—comprise 81% of the steel mill lost time cases and only 22% of the railroad cases. The contusion, sprain, and back categories by contrast comprise 13% of the steel mill cases and 72% of the railroad cases. The latter grouping is made up of diagnoses primarily based upon history and no doubt include such cases as tendonitis, bursitis, and tenosynovitis.

In the amputation category, one steel mill case involved loss of a great toe at the metatarsophalangeal joint. The remaining six steel mill cases and one railroad case were all of phalanges, or parts thereof, of the hands.

The one steel mill back case belongs more properly in the contusion category, for, in fact, multiple contusions were incurred. Back symptoms predominated, however, and a spondylolisthesis was found on x-ray examination. The 15:1 ratio of railroad low back cases to steel mill low back cases is at least partially the result of different criteria for acceptance of cases. During this same interval, 117 low back x-ray examinations were performed on steel mill employees and 45 on railroad employees, indicating that steel mill employees were not free of back complaints.

The fracture category of the lost time cases is chosen for further analysis because diagnosis is objective and the usual course of the condition well known. Table III lists the fractures involved in these lost time cases under consideration. Within some of these groupings certain observations can be made. The fractured pelvis of the steel mill employee was of the Malgaigne type and was accompanied by injuries to other parts of the body; that of the railroad employee was of both pubic rami without significant displacement. Three of the phalanx fractures of railroad employees were of distal phalanges of great toes and one of the middle phalanx of the second toe. None of these fractures were open; none involved joints. By constrast, one of the steel mill phalanx fractures required skeletal traction, another involved a lacerated tendon, and the third required skeletal traction and a skin graft. These phalangeal fractures thus are hardly of equal severity.

An interesting comparison was obtained in this fracture category by tabulating actual time lost and average recovery periods as recorded by McBride.[1] The discrepancies would be greater if associated traumata, such as tendon injuries, were included. In both steel mill and railroad cases, only the fracture was considered.

One could analyze these cases more thoroughly and more precisely, of course. Only enough detail has been presented to illustrate that in the case of the steel mill and the railroad distinctly different impressions are obtained when viewed from the standpoint of what happened to the employee and what was indicated by safety performance as measured.

Reasoning by hindsight is potentially dangerous, but analysis of these cases leads to the estimate that five and perhaps six of the railroad employees would have represented lost time cases had they worked in the steel mill. This is quite in line with relative man hours worked, the ratio being approximately 11:1 for

Table III—A Description of Fracture Cases, Steel Mill and Railroad

	Steel	Rail
Pelvis	1	1
Long bones	7	1
Lateral malleoli	2	..
Tarsal	2	..
Metatarsal	3	..
Metacarpal with phalanx	1	..
Metatarsal	..	1
Phalanges	3	4
Supraorbital ridge	1	..
Ribs	1	1
Total	21*	8

*Two fatalities excluded.

*Table IV—Actual Lost Time Compared with Average Time Lost, Steel Mill and Railroad Fracture Cases**

	Cases	Days Lost	Estimated Days*
Steel mill	21	1,495	1,601
Railroad	8	1,274	490

*Data from McBride.

man hours and the steel mill had 53 lost time cases for the year.

Discussion

What are some of the factors which contribute to frequency and severity rates in the two industrial situations discussed other than the injury involved? These variables can be loosely grouped into at least three headings. There are those variables oriented about (1) the patient, or employee, (2) the work situation, and (3) the medical care involved.

1. Patient variables such as age, general health, family situations, and emotional health can lead to wide differences in time necessary to recover from specific injuries to such an extent that return to work is practical. These variables would probably be neutralized from one company experience to another over a long period of time with adequate sampling of the population involved. In any one year, however, because the population sample involved in lost time cases is small, considerable reflection on safety rates could result.

2. The work situation and its contribution to lost time can be well illustrated in the two industries under discussion. On-the-job rehabilitation on a small railroad is extremely difficult. Most lost time cases occur among trainmen. Their jobs require climbing on and off freight cars, throwing switches, and working under all sorts of weather conditions. To further complicate the matter, in general a trainman works as a trainman or not at all. The situation is almost comparable to that in the armed forces, where one either did full duty or became a patient in a hospital. Occasionally, a man has seniority and training to permit tower work or flagman duties. but these are usually the only easier jobs available to the occupation and these jobs are quite limited in numbers. Jumping off a freight car into a bed of slag is hardly advisable for a man with a recently fractured toe or sprained ankle. A man with a second degree burn of the hand of consequence or a significant laceration of the hand cannot hold on to a grabiron of a moving freight car without some added risk to himself and the injured part. These injuries would seldom, if ever, lead to loss of time from work in a steel mill, where on-the-job rehabilitation in relatively minor cases is less difficult.

A considerably different compensation arrangement exists in the steel mill and the railroad. The mill worker is covered by provisions of a state compensation law. When injured, he is compensated to the extent of approximately half his usual wages. The Federal Employers Liability Act applies to injuries occurring on the railroad under study. Although not a compensation law as written, in practice it generally is so applied. Litigation experience has led most railroads to make damage settlements of at least lost wages in most injury cases. Thus we have the situation where a mill worker is compensated to the extent of about half his lost wages when injured, and the railroad worker receives commonly at least his wages when off work for injury. It would seem likely that this compensation difference would play some part in determining the length of time off work following injury.

Numerous other work situation variables exist which influence length of time off work following injury. The two discussed are perhaps most significant in comparison of the two situations, steel mill and railroad, presented here.

3. Medical care exerts an influence on lost time performance. Early ambulation, antibiotics, and better management of fluid balance are three medical contributions which have improved recovery time from injury. There are, however, medical factors which have done the opposite. Skin graftings, particularly in cases of burns, have led to lost time cases in employees who previously worked while their wounds granulated. Objectively, however, this does not alter the severity of the original burn.

Medicine remains an art as well as a science; and, although standardization of procedures is common, each patient must be treated individually. Judgment is required as to the proper time for a man to return to work following an industrial injury, just as with nonindustrial problems. Some physicians are more conservative than others; some geographic areas are more conservative than others. These differences may reflect opinion of respected medical leaders in an area. They may reflect the malpractice climate of an area. Regardless, the physician has the ultimate patient responsibility, which he cannot delegate. These differences lead to variations in lost time for similar injuries.

Medical complications frequently are unrelated to the severity of the initial injury. Phlebitis, osteomyelitis, or pneumonia, for example, may occur in one of a hundred cases of similar objective injury. These factors are beyond safety considerations and should, with other patient variables, equalize over a long sampling period. Again, however, one case can materially alter safety performance during a specific time interval.

One would hope that development of a code based upon injury characteristics alone, would lead to inter- and intra-industry comparison of all injuries, not just those that lead to "lost

time." Certainly a wealth of epidemiological data is lost by comparisons of only this small percentage of accidents. If, for example, one company has few or no fractured fingers and another company in the same industry has many, attention could be directed to those factors which relate to use of the hands and differ in the two companies.

An additional value of uniform comparison of all injuries would be to focus attention on some of those factors other than safety performance presently measured by safety rates. Why should a certain fracture be a disabling injury in one instance and not in another? Are facilities for on-the-job rehabilitation superior in the one instance? Are there consistent wide variations in medical opinion as to which patients can return to work? These question cannot be accurately answered with existing data.

Summary and Conclusions

Two contrasting industrial safety performances have been considered. Distinctly different impressions of these performances are obtained if one first considers the frequency and severity rates and then considers the actual injury experience theoretically measured by these rates.

Extension of prescribed values for all injuries, such as exist for amputations and fatalities, would materially improve existing measurements. Such values could be assigned to fractures without great difficulty. Less well defined conditions are not so readily adapted to objective evaluation, but a workable schedule could be devised by conference of safety and medical personnel conversant with the field.

The many potential values of a uniform industrial injury code would seem to outweigh the hard work necessary to develop such a code. Safety personnel would welcome more objective measurements than exist today but must enlist our interest and help in development of such a code.

The three groupings of variables revolving about the (1) patient, (2) work situation, and (3) medical problems can be much further evaluated. Only a few aspects have been considered, but all of those discussed have two characteristics: (1) All could influence whether a man will lose time and how much time he will lose and (2) none are properly charged or credited to safety performance. Safety departments and programs are thus assessed partially by factors rather remote from safety performance.

Dr. Halen's address is 2709 E. Carson St., Pittsburgh 3.

Reference

1. McBride, E. D.: Disability Evaluation, Philadelphia, J. B. Lippincott Company, 1953.

YALE UNIVERSITY

offers

SUMMER SCHOOL OF ALCOHOL STUDIES
SEVENTEENTH ANNUAL SESSION

June 28 - July 23, 1959

An interdisciplinary study of problems of alcohol and alcoholism in society.

Lectures and seminars under the direction of specialists drawn from the social sciences, medicine and psychiatry, religion, education and public health.

Workshops for physicians, case workers, psychologists, clergy, nurses, educators, probation, parole and correctional officers, personnel directors and supervisors in industry, community leaders.

For a prospectus describing the course, information concerning admission and academic credit, write to: Registrar, Yale Summer School of Alcohol Studies, 52 Hillhouse Ave., Yale Station, New Haven, Conn.

Physiological Problems of Space Flight

Lieut. Col. Stanley C. White (MC), USAF, and Capt. Charles L. Wilson (MC), USAF

THE LAUNCHING of the recent series of satellites has opened up a new frontier of flight, a new manifest destiny. It will be possible to fly through the atmospheric shell of the earth to the far reaches of the gravitational pull beyond. Such a flight will be primarily astronautical—not aeronautical—since only a brief part of the flight will be through the air layer. The objectives of this article will be to discuss what is currently known about some important stresses of rocket flight, to outline areas of incomplete knowledge, and, most important, to show some of the ways by which animals and man can be safely protected during rocket flight. It must be assumed that man ultimately will be integrated into the rocket vehicles of the future. Naturally, man will desire, and a humane philosophy will demand, that the human subject be returned safely. Biomedical and aviation medical personnel have collectively defined the necessary requirements to protect the subject. It is a reasonable estimate that early rocket vehicle flights will have an 85% chance of complete success. By complete success, one means that every component of the aircraft worked flawlessly during the flight—the airframe, the propulsion system, the guidance and controls—and that the man did not sustain any injury. The 85% estimate of complete success on early missions is a reflection of past experience gained in the X-series aircraft, such as the X-1, which first penetrated the sound barrier, the X-2, which established the world's altitude record of 126,000 ft., and soon, the X-15. It requires years of painstaking and deliberate planning to build such awesome aircraft.

Truly the engineer and the biological scientists must work side by side with a mutual comprehension of both engineering and biological problems. The physician, if he is to be a useful team member, must refresh and expand his knowledge into the fundamentals of physics and astronautics. An example is the concept of the "q" factor, a function of air density and vehicle speed.

A rocket vehicle traveling at 10,000 miles per hour in a vacuum would not generate any external heat by molecular friction; also, there would be no shock waves to cause vibration of the vehicle. However, the same aircraft, traveling at the same speed near sea level, would generate heat and vibration loads which would be immediately catastrophic to humans. It is obvious that rocket exit, and especially reentry, will pose a potent threat to the pilot.

Consider the more important anticipated stresses which will assail the space or rocket pilot in flight. He will experience the intense apprehension and anxiety during countdown, blast off, and reentry. He will be exposed to accelerations which crush mightily on the chest and render the extremities immobile. He will experience harassing and disorienting noise levels (120-140 db). If the trajectory is not smooth, he will receive severe vibration loads which experimentally have caused typical angina pectoris, melena, and hematemesis. He will be completely dependent on an artificial atmosphere and endure the sensation of weightlessness—at times exhilarating, at times frustrating. Finally, he will be exposed to the intense radiation belt during part of the flight.

There are many technically capable people, aware of these dangers and consequences, who are ready and willing to volunteer for such a flight. The reasons that they are eager to go cannot be passed off by labeling them as scatter-

Lieut. Col. White (B.S., M.D., M.P.H.) is a research flight surgeon, who is associated with The Space Task Group, National Aeronautics and Space Administration, Langley Research Center, Langley Air Force Base, Virginia. Captain Wilson (B.S., M.D.) is Aeromedical Examiner and Research Physician, Respiration Section, Physiology Branch, Aero Medical Laboratory, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio.

This article was read before the American College of Preventive Medicine, St. Louis, Oct. 30, 1958.

brained daredevils. They have experienced high "g," moments of weightlessness, sudden low barometric pressures called "rapid decompressions," and fear up to and including sheer panic. A few of them have had rocket experience in the X-series aircraft, such as Kincheloe, Yeager, Ziegler, Apt, White, and Crossfield, to name a few. Men such as these understand the stresses and are thoroughly familiar with the idiosyncrasies of the rocket vehicles they fly. Something more, they have learned about themselves—how they perform in an emergency.

The rocket capsule must have an atmosphere. The atmosphere surrounding the pilot must provide pressure to his body; otherwise the tissue fluids will vaporize. This will cause the exposed part of the body to swell into a spherical form. This vaporization of tissue fluids, termed "vapoedema" by Mr. Donald Rosenbaum, of the Aero Medical Laboratory, who first described it, can be produced by exposing the hand of a human dressed in a pressure suit (Figs. 1 and 2). When the chamber pressure reaches 63,000 feet, or 47 mm Hq, the water at body temperature begins to become a gas. The gas dissects along loose fascia planes between the skin and muscle and around the insertion of muscle, as seen on the X-ray film. A suitable pressure to protect the human will be 5 psi, or 1/3 atmosphere, consisting of 100% oxygen.

Fig. 1—Human hand at normal barometric pressure.

Fig. 2—Same human hand with gas under skin on back of hand and wrist at 95,000 feet barometric equivalent.

When the partial pressure of oxygen is insufficient, hypoxia and death do occur. When the partial pressure of oxygen is excessive (such as 100% oxygen at 2 or 3 atmospheres of pressure), an equally fatal malady can obtain, namely, oxygen toxicity. The term "oxygen toxicity" denotes a clinical malady which results from prolonged exposure to high partial pressures of oxygen. When the pO_2 is very high, such as 3,000 mm Hg (which results from breathing 100% oxygen at 100 feet depth in the sea), the onset of the illness occurs in 5 to 15 minutes. When the pO_2 is less, it takes longer time for onset of symptoms, which are poor coordination, muscular twitching, nausea, headache, which if allowed to progress will end in convulsions and death. Speculation as to the etiology is centered about the inability of the oxyhemoglobin to transport carbon dioxide from the tissues and the presence of toxic hydroxy ions in the tissues.

Oxygen toxicity will not be an operational problem in the Air Force, but it has been among Naval personnel and deep sea divers, since these persons routinely work with pressures greater than one atmosphere and occasionally must use 100% oxygen.

In a small cabin volume, exhaled gases present further problems. Most of the water vapor must be removed, in addition to all of the carbon dioxide. Chemicals such as lightweight lithium hydroxide are being incorporated, since they combine with both carbon dioxide and water. The entire atmosphere in the space craft is sealed from the outside atmospheres. Each exhaled breath of the pilot must be parsimoniously reconditioned in order to avoid a rapid depletion of the oxygen supply by dumping the exhaled breath overboard. A system in a sealed cabin which maintains a constant atmospheric pressure, a constant and safe pO_2, pCO_2, and

Fig. 3—Full pressure suit capable of protecting a human in a perfect vacuum.

pH_2O by recirculating the gases, is called a closed-circuit system. The closed-circuit system is not unlike the system which the anesthetist uses.

In early prototype flight, the pilots will wear full pressure suits—which are really only emergency tailor-fit space cabins (Fig. 3). These pressure suits will be worn unpressurized during normal cabin pressurization. If, however, there is a structural failure or other event which causes the cabin atmosphere to explode out into the surrounding vacuum, the pressure suit emergency system automatically detects the cabin loss and inflates the full pressure suit, literally in a split second.

Acceleration is another gigantic stress. During blast-off, the subject could experience 6 to 8 g in three bursts for about 200 to 250 seconds. To imagine what 8 g is like, lay 100-pound bags of cement on your chest and extremities. One rapidly learns to breathe with the abdominal muscles to compensate for loss of rib mobility. The arms are too heavy to move, but the fingers can perform simple manipulations. Certainly an experimental subject can well tolerate the accelerative forces for the time interval programmed. A strategic physiological fact in protecting the pilot during boost phase is the positioning of the body with respect to the force of acceleration. Normal populations of humans can withstand 3.5-4.5 positive g during an inside loop without experiencing the blackout that accompanies temporary retinal ischemia. However, one can tolerate only 2-3 negative g during an outside loop because of the discomfort of venous engorgement. The most effective way to endure acceleration is to lie down, with the feet elevated (Fig. 4).

As the last stage of the rocket burns out, acceleration ceases and a new and curious phenomenon appears: weightlessness—the absence of counterforce. A U. S. Air Force C-131 aircraft used by the Aero Medical Laboratory flies a tricky maneuver called a Keplerian trajectory—named in honor of Auguste Kepler, the astronomer. About 15 seconds of weightlessness develops (Fig. 5). The effects of normal muscular effort are magnified greatly because a weightless object needs much less energy to move it. The subject pushes gently away from one wall and finds that he can glide many feet in the confines of the large aircraft effortlessly. Some interesting questions arise: Will man's muscles atrophy if he remains in a weightless state for prolonged periods? Will he ever become accustomed to the feeling of constant falling? This is one of the most difficult areas to study, short of actual orbital flight.

Two other knotty problem areas exist: First, is the matter of radiation. Information returning from the satellites and the sputniks has led to the discovery of a mammoth ocean of radiation surrounding the earth. The shores of the radiation begin about 400 miles above the earth's crust. Radiation intensity increases greatly to 10 r per hour at 1,200 miles. Recent data indicate that radiation drops off to 2 r per hour at 17,000 miles. Research is in progress,

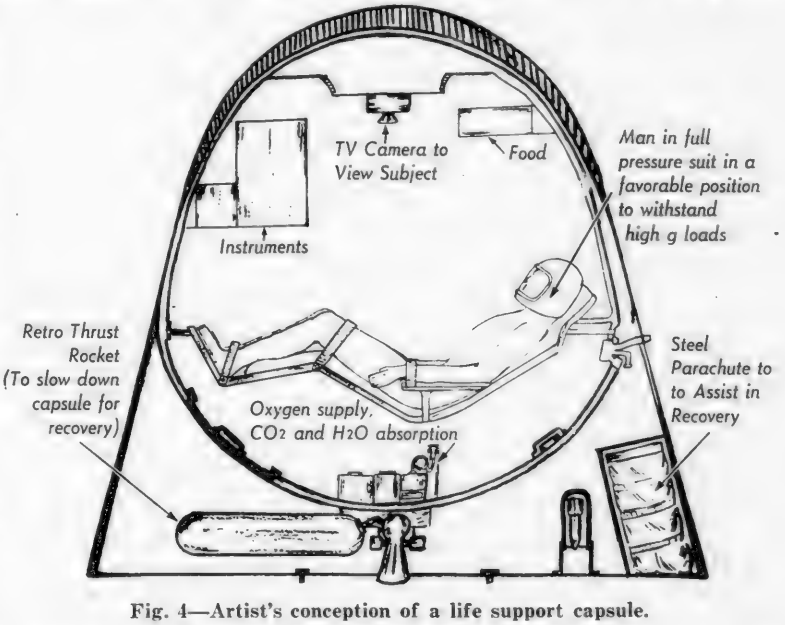

TV Camera to View Subject
Food
Man in full pressure suit in a favorable position to withstand high g loads
Instruments
Retro Thrust Rocket (To slow down capsule for recovery)
Oxygen supply, CO_2 and H_2O absorption
Steel Parachute to to Assist in Recovery

Fig. 4—Artist's conception of a life support capsule.

Fig. 5—Subjects floating weightless in C-131 aircraft during a Keplerian trajectory. Courtesy Maj. Edward L. Brown, Aero-Medical Laboratory.

studying how to protect the pilot from this additional hazard. Although lead shielding may be thick enough to eliminate that hazard, it could increase the weight of the space vehicle prohibitively.

Second, and perhaps most perplexing, is the man's psychological composition. How can the final choice be made? Who is genuinely and maturely motivated? Who can be depended upon in the remote but possible emergency? How will he react to the mounting stresses during exit, orbit, reentry, and landing? One study among many is being conducted by the Stress and Fatigue Section at the Aero Medical Laboratory. Volunteer subjects are first interviewed at great length by psychiatrists, then placed in a completely dark, soundproof room for an indefinite time. They have food in a refrigerator and a bed, a chair, and a commode. What allows one subject to stay seven days in total darkness —not a sound—no one to break the monotony? What causes another equally willing volunteer to quit at the end of 20 hours? Such tests are dissecting the anatomy of isolation. From these severe tests we can better provide a comfortable atmosphere for the pilot. This isolation chamber does not duplicate the isolation of rocket craft. The pilot should have illumination, a time reference, communication with the earth, "hi-fi" music, perhaps a television screen to view his friends and technicians on earth.

In conclusion a great abundance of knowledge exists presently on what to expect during rocket flights. Unsolved problem areas such as radiation and weightlessness are being attacked vigorously and several solutions are in sight. The most important part of the flight is to recover the pilot safely—and the engineer and biological scientists will not cease until they are assured of his complete safety.

The authors' addresses are 20 Westbrook Drive, Hampton, Va. (Colonel White), and 5585 Hickham Drive, Dayton 31, Ohio (Captain Wilson).

Cancer Detection Activities in Industry

ELEVEN YEAR FOLLOW-UP REPORT

T. J. Bulger, M.D., and A. J. Fleming, M.D., Wilmington, Delaware

IN AN ATTEMPT to improve the cure rate for cancer, The American Cancer Society initiated a program in 1947 which might be classified as a public educational method in which the public was encouraged to present themselves to a cancer detection center periodically. The principle behind the program was to have people present themselves at these detection centers at a time when they thought themselves to be entirely well and free of any cancer, and in this circumstance, the physicians at the centers could perhaps detect silent, asymptomatic, early lesions which, it is agreed, are more amenable to successful treatment.

Again, The American Cancer Society from a practical aspect was in possession of funds which permitted the forward motion of this program. Accordingly detection centers were established throughout the United States with the above-mentioned objective in mind. In most instances, the centers became a function of the out-patient department of community hospitals; and in many cases, the centers were organized along the lines dictated by the member physicians. Subsequent experience indicated that many of the centers were a success, and these have continued to function; whereas others have decided to discard this type of case-finding, many because of the cost.

In the state of Delaware, the cancer-detection center method was inaugurated along rather simple and practical lines and managed to progress and function efficiently. All women over 40 years of age (and this age limitation was lowered later to 30 years and then even later to 25 years of age) would be encouraged to submit themselves to a screening type of physical examination which would be primarily directed toward evaluation of breast, axilla, neck, pelvis, and rectum. Thus would be covered the most frequent sites of cancer in the female and obviously also sites which were visible and palpable. In addition, a Papanicolaou smear of the cervix and vaginal and cervical secretions was taken. Included, of course, were such obviously allied potential cancer sites as the skin lesions which would be seen, such as nevi, basal-cell carcinoma, leukoplakia, adenomas of the thyroid, and kraurosis.

Dr. G. H. Gehrmann, then Director of the Medical Division of the DuPont Company, participated in this early planning stage of the program and saw the potential value of its use in the medical activities of the medical division of the DuPont Company. He concluded that it should be offered as part of the examination of the female employees on a voluntary basis.

Accordingly then, the program was initiated in 1948. The female employees were notified of availability of the company-operated detection center and were invited to appear for examination. Naturally the program received a tremendous impetus as a result of the educational propaganda submitted to the public through the efforts of the American Cancer Society. The convenience of having the examination while at work, as well as the basic reasons for the program, were responsible for the appearance of 230 women in 1948 for this examination.

Almost from the start, the program indicated that it was going to succeed in its purpose and advance the cause of early detection and treatment. The news of the periodic finding of a case invariably filtered through the organization with the result that more and more employees realized its value and availed themselves of this opportunity for examination. There has been a steady increase in applications until at present, in the year 1958, or 11 years later, we

Dr. Bulger is Consultant Surgeon, and Dr. Fleming is Medical Director, E. I. du Pont de Nemours & Company.

had a total of 1,500 examinees. Of course, as time progressed, we took the opportunity of informing the employees of the value of reexaminations. Eight previous negative examinations would not exclude the possibility of finding cancer in the ninth examination; in fact, the chances of early detection would be increased with each succeeding examination.

Concurrently with the establishment of the detection center, The American Cancer Society also tried to inculcate in the minds of the doctors the fact that each physician's office should function as a detection center. And here, again, each physician performing the routine annual or periodic examination in the medical division of the DuPont Company was alerted to the possibility of case-finding. Normally, each employee receives an annual physical examination, which includes a blood count, chest roentgenogram, urinalysis, history, and physical examination. "Lead" questions, such as rectal bleeding, vague gastrointestinal symptoms, and, chronic cough, were put to the employees in an effort to uncover an occult neoplastic lesion.

For a time, employees with suggestive gastric or vague gastrointestinal symptoms were subjected to a screening type of gastrointestinal x-ray examination, performed by a photofluoroscopic roentgen unit similar to the one used by Morgan and his group at The Johns Hopkins University. The yield from this particular effort turned out to be too meager, and the procedure was abandoned.

Finally, patients with rectal symptoms or signs of bleeding were advised to appear for a sigmoidoscopic examination. Our experience with this approach has fallen far short of that reported in some series for conditions such as adenomatous polyps. We find slightly less than 4%. On the other hand, we have seen numerous hemorrhoids, hypertrophic papillae, fissures, fistulae, and others. As our experience accumulates, the percentage of polyps may be adjusted upward.

In summary, then, it would appear that the employees of the DuPont Company were being exposed to the benefits of the rather comprehensive cancer-detection routine.

As a result of this examination procedure from 1948 to 1958, among the employees in the administrative home office buildings of the DuPont Company as well as the manufacturing or laboratory areas immediately adjacent to the home office, we found a total of 55 malignant lesions of the breast, rectum, cervix, skin, thyroid, and ovaries, listed in the Table.

There were over 100 basal cell carcinomas of the skin which were not included in this case-finding report. This entailed the performance of 9,000 examinations. Our records do not permit us to be sure how many of these were found on the original examinations and how many on reexaminations.

Types and Number of Malignant Lesions

Breasts	15	
Cervix	17	(4 invasive, 13 preinvasive
Rectum, sigmoid colon	9	
Thyroid	4	(cell with positively involved regional nodes)
Melanoma	4	
Neurilemmoma	3	
Lymphoma	2	(reticuloma-cell, Hodgkins)
Ovary	1	
Total	55	

In addition to these malignant conditions found, there was an approximate yield of 10% of the total examinations which revealed benign conditions requiring treatment, such as rectal polyps, ovarian cysts, uterine fibroids, cystoceles, and benign breast tumors.

Of particular interest is the fact that all but one of the employees found to have these malignant lesions are alive and at work at the present time or have retired, thus representing survival rates in terms of 1 to 10 years. It is reasonable to assume that in some of these cases there are potentials for recurrence, but, on the other hand, it is reasonable to conclude we may expect the normal incidence of cancer cure. On the optimistic side, we can perhaps expect the carcinoma in situ lesions to approach approximately a 100% cure rate, whereas heretofore, as we are all aware, in evasive carcinomas of the cervix, our best statistics indicate that we could expect only approximately a 40% cure rate. Incidentally, in our experience, there seems to have been a steady climb in the case-finding rate of carcinomas in situ. Undoubtedly, this is due in part to the increased number of patients applying for examination, but we are certain, it is also due in part to the increased interest as well as experience of our laboratory cytologist. The clinical entity of carcinoma in situ, or preinvasive carcinoma, of the cervix was on trial for a short period of time, but, according to the reports in the 1956 First International Cancer Cytology Congress, it would appear that this diagnosis is firmly established; and also that the validity of the method of cytological detection by screening methods has been proved, so that, in the final analysis, we have a theoretical and perhaps a practical means for the eradication of cancer of the cervix as a cause of death.

In reviewing case histories, some interesting discoveries were made; for instance, we are aware of the dalliance on the part of a great many members of the lay public in seeking medical help, but we were surprised to find, as Dr. Pack expressed it, five "board-qualified" physicians "culpable of delay" in that they were watching "tumors of the breast." Two of these were obvious clinical cases of carcinoma of the breast. However, one patient had a "pea-sized" lesion which was clinically benign, but frozen section revealed an adenocarcinoma. Another patient had previously been operated upon five separate times for benign tumors of the breast, and when a sixth lump appeared, she was "reassured" for three months before a radical mastectomy was performed for carcinoma. We are all challenged on occasion by the patient who returns some time after an excision of the breast and subsequent report of a benign condition to inquire whether the induration in the biopsy scar is significant. One of our cases was of this type, and frozen section revealed the suspicion-arousing induration to be adenocarcinoma. Another type of breast tumor which is likely to lull us into a complacent attitude is the cystic mass from which fluid is aspirated and we conclude, therefore, that it is benign. In one of our cases such a mass proved to be a papillary cyst adenocarcinoma.

One of the patients with a malignant lesion of the breast continued to report for annual rechecks and two years later was found to have a malignant growth in the other breast which was interpreted as representing a second primary lesion.

We are unable to express statistically the number of benign breast tumors found in relation to the malignant tumors, but believe it to be approximately 10 benign to 1 malignant in this selected group.

This same statement applies to melanomas, and to benign adenomas of the thyroid.

Secondly, there is an apparent reluctance on the part of doctors and nurses to accept what they know to be the truth when it applies to them; to wit, we had both a doctor and a nurse in this series who developed carcinoma of the rectum and whose lives have been prolonged only by propitious circumstances.

The actual mechanics of procedure which we used in conducting our examination are of interest.

The first step is to circularize all female employees above 25 years of age by sending out a notice. The notice tells about the examination and what it involves and encourages the employees to be examined. The employees indicate their willingness by submitting their names and telephone extension number on the notices which they have received, and these are returned to the receptionist in the medical division. Once the receptionist has all of these acceptances returned, she merely sets up a schedule which is convenient for the medical division so that its routine functions are not disrupted. It has been our practice to examine approximately 40 employees a week, and in order to do this we set aside about four hours of each of two afternoons a week.

The examining team consists of the receptionist, an examining physician, an examining nurse, a secretary, and a cytologist. The cytologist, of course, is not present at the time of the examination; we merely submit our slides to her when we have collected them at the end of the examination period. Obviously, not all of these people are necessary, but we happen to have them in our medical division and they schedule themselves to participate in functioning at this time in order to make the program work easily and smoothly.

Insofar as space is concerned, it is of advantage to have a waiting room, a dressing room, and two examining rooms, the patient actually entering them in that order. In the waiting room, the patients are asked to fill out a history sheet. They then enter the dressing room, where they are instructed to strip to their shoes and stockings and don a long hospital gown. They are positioned by the nurse in the lithotomy position on a stirrup table in the usual manner. The examiner conducts his pelvic and rectal examination and uses a spatula for obtaining the cervical secretion for making the smear. We use an inexpensive "throw-away" type of plastic gloves rather than the usual rubber gloves for the bimanual pelvic and rectal step and believe it to be a time and money saver. The slides have been numbered and names written on the ground glass end with an ink which withstands the 50% ether-alcohol solution into which the slides are immediately placed. The patients enter the examining room with their history forms filled out, and the physical examination results are immediately tabulated on a form. In this manner, by going from one examining room to another, the physician can easily and efficiently complete a schedule and run patients through at an average rate of one every 5 to 10 minutes. Occasionally brief recommendations and explanations of findings are made to patients, and, on occasion, they are requested to return at another time for a more detailed discussion. Patients requiring treatment for positive findings or for more detailed inquiry are referred to their private physicians (whose names are recorded on the history form.)

The equipment and supplies, such as specula, lights, stools, and tables, are the usual ones.

Finally, there is a summary report, which includes the Papanicolaou smear findings. Grades I and II are regarded as normal. Grade III is suspicious, and Grades IV and V are regarded as cancer. All patients with lesions graded III, IV, and V are advised to have ring biopsies and dilatation and curettage to confirm the findings.

The cytologist studies and screens all slides and refers her suspicious findings to the pathologist. It is estimated that one cytologist can stain and screen 3,000 to 4,000 slides a year.

Conclusions

This method of screening has resulted in a yield of 6.1 cases per thousand in our experience. Some may argue that this is too costly and laborious an effort, but, in the case of our industrial medical health service, there seems no excuse for not including it as an integral part of the program. As far as employee-time lost is concerned, it is negligible, especially when one considers that the examination takes less time than the usual coffee-break, which practically every employee indulges in every day—not just once a year. Again this yield may not be too impressive, but to some of the 55 patients, it may represent the value of life itself.

The yield does not, of course, represent the true incidence or prevalence rate in our total employee population; rather, it represents the result of a special effort or program of cancer detection.

There are some gaps in our statistical data, but in the future with the aid of a biostatistician, who is now on our staff, this condition will be rectified.

Summary

As the result of an 11-year experience in cancer-detection involving 9,000 examinations, 55 cases of malignancy were diagnosed and all the patients accepted treatment. At the time of the preparation of this report, all except one of the employees are alive and working or retired. This represents a 1 to 10-year follow-up survival. It also indicates a 0% surgical mortality rate.

There were more than 900 benign conditions diagnosed for which treatment was advised.

We feel the program of cancer detection has proved its value as part of an industrial health service.

The authors' address is E. I. du Pont de Nemours & Co., Wilmington 98, Del.

COLBY COLLEGE

Waterville, Maine

presents

INSTITUTE ON OCCUPATIONAL HEARING LOSS

August 17-22, 1959

This course, presented for seven consecutive years, is designed to train otologists, and others interested in the problem of occupational hearing loss, to initiate and conduct hearing conservation programs in noisy industries. To allow for maximum individual instruction, course enrollment is limited. The diversity of experience of the faculty members, assembled especially for this course, provides an unusual opportunity for personal consultation on any aspect of occupational hearing loss.

The fee of $200 includes tuition, board and room. Requests for further information should be made to William A. Macomber, Colby College, Waterville, Maine.

The Legal Scope of Industrial Nursing Practice

Although this article is readily available in the original to most of the readers of this journal, it is considered to have such significance for all physicians in industrial practice as to warrant republishing here.—Editor

This report has been prepared by the Committee on Industrial Nursing of the Council on Industrial Health, American Medical Association, in collaboration with the Association's Legal Division.—B. DIXON HOLLAND, M.D., *Secretary, Council on Industrial Health.*

THE PURPOSE of this report is to discuss the legal scope of the practice of industrial nursing and the functions which a professional industrial nurse may legally perform. The intensification of the educational program of nursing, the increased dependence of the physician on the skills and discretion of the nurse, and the ability of the nurse to meet the challenge of an ever-rising standard of patient care have motivated the nursing profession to define and seek recognition for those professional functions which the nurse performs independently. This is especially true of the industrial nurse who often works without immediate medical supervision.

The Practice of Nursing

Nursing and medical practice are interrelated and frequently indistinguishable from each other. The same act may be clearly the practice of medicine when performed by a physician and likewise a practice of nursing, depending on the circumstances, when performed by a nurse.

There are, of course, limitations on the functions which the nurse may perform, whether independently or under the supervision of a physician, and there are likewise limitations on the functions which may be legally assigned by a physician to a nurse. These will be discussed in this report.

The statutes of the various states which define professional nursing are too nebulous to provide a usable guide in determining the functions in which a nurse may legally engage. Essentially the statutes define professional nursing as involving the carrying out of treatment prescribed by a licensed physician and the application of nursing skills. Obviously, such definitions do not identify the particular functions in which a professional nurse may engage.

Probably the lawmakers should be commended for their foresight rather than criticized for ambiguity. A half-century ago when the first nursing practice acts were adopted the principle function of the nurse was to aid the physician by performing tasks under his direction. The functions of nursing are constantly expanding, and precisely drawn statutory definitions of the functions of nursing could not be kept up to date with changes in professional practices. However, the growing body of judicial decisions reflects the development of the profession of nursing and its expanding responsibilities in the wake of medical progress. The identification of particular functions as nursing functions and the standards of competence required of professional nurses in executing these functions have undergone a rapid and continuous process of evolution among those who are professionally responsible for the care of the sick and injured.

Courts have held that professional nurses have a legal duty to interpret evidence presented by the patient possibly indicating the need for medical attention, and to proceed in the light of that interpretation to do what is required for

---

The members of the Committee on Industrial Nursing are Jermyn F. McCahan, M.D., Chairman, Chicago; Mary Louise Brown, R.N., New Haven, Conn.; David H. Goldstein, M.D., New York; Emmett B. Lamb, M.D., Indianapolis; Katharine A. Lembright, R.N., New York; O. Tod Mallery Jr., M.D., Wausau, Wis.; Charles F. Shook, M.D., Toledo; Sara P. Wagner, R.N., New York. The consultant from the Legal Division is Mr. Bernard Hirsh, Chicago.

Reproduced with permission from the *Journal of the American Medical Association*, 169:1072 (March 7) 1959.

the patient, as for example the need to call a physician[1]; to discontinue a treatment where there is evidence of its harmful effect, e. g., on an unconscious patient[2]; or to determine the patient's need for special medication, e. g., sedatives.[3] There can be little doubt that by custom and usage the relationship between doctor, patient, and nurse is one in which the parties recognize that the nurse as well as the physician has the function and responsibility to observe and interpret the patient's reactions.

The observation of symptoms and the making of a diagnosis imply the need for professional learning and mental acuteness. These functions are characteristic of the professional nature of nursing as well as medicine. The industrial nurse who observes the extent of illness or injury to an injured workman and determines whether she should render emergency treatment or wait until the physician arrives has made a vital diagnosis comparable in importance to many of those which physicians are called on to make. However, except for first-aid treatment and the employment of such measures as will prevent aggravation of the patient's injury or illness, the determination of therapy is within the exclusive domain of medical practice and beyond the limits of nursing practice.

Nurse's Malpractice

In *Cooper v. National Motor Bearing Co.*[4] the defendant appealed from a judgment in favor of the plaintiff in a malpractice action brought against a registered nurse and her employer.

In May, 1951, the plaintiff received a puncture wound on his forehead when another employee let a piece of metal slip from his hand. He went directly to the first-aid room and received treatment from the defendant nurse. She swabbed the wound with an antiseptic and put a bandage on it. According to the plaintiff's testimony she did not examine or probe the wound. He was told to return the next day which he did. The nurse again applied antiseptic but did not probe the wound. On the next day he also went to the dispensary, but on that occasion the nurse just looked at the wound.

On visits to the dispensary over a period of several months the plaintiff would point out to the nurse that the wound did not seem to be healing properly and she would say that if it did not she would have do do something. In March, 1952, the plaintiff visited the dispensary for a check of a chest injury and asked the nurse if she would send him to a doctor to examine his forehead. She referred him to a physician who excised a piece of tissue for laboratory examination. A pathologist examined the specimen and reported that it contained a basal cell carcinoma. On March 23, 1952, the plaintiff was operated on and a larger area was excised. Skin was removed from his right forearm and grafted to the forehead.

The plaintiff's case was tried on the theory that a metal splinter was left in the wound by the negligence of the nurse and that this foreign body, acting as an irritant, caused the cancer.

The nurse admitted that it was her duty to refer any condition or injury she was not familiar with, or sure about, to a doctor for diagnosis. The standard of good nursing care in the community required the nurse to examine the wound for foreign bodies. If splinters were too deeply embedded, the nurse was to send the workman to the doctor. The plaintiff's type of wound should normally have healed in about a week. If a wound persisted and did not heal, proper nursing care would require that the workman be sent to the doctor. The nurse admitted that she was familiar with the danger signals of cancer, one of which is "any sore that does not heal." Nevertheless she continued to treat the wound for 10 months before sending the plaintiff to the doctor.

In affirming the judgment of the trial court, the California District Court of Appeal said:

> A nurse's diagnosis of a condition must meet the standard of learning, skill and care, to which nurses practicing that profession in the community are held. A nurse in order to administer first aid properly and effectively must make a sufficient diagnosis to enable her to apply the appropriate remedy. Usually she receives some history of the accident or illness from the patient, inspects a wound, and bases her choice of treatment on the deductions thus made. She has been trained, but to a lesser degree than a physician, in the recognition of the symptoms of diseases and injuries. She should be able to diagnose, according to appellant nurse's own testimony herein, sufficiently to know whether it is a condition within her authority to treat as a first aid case or whether it bears danger signs that should warn her to send the patient to a physician . . .
>
> Appellant nurse testified that it was the practice of a nurse in this type of industry to probe wounds for foreign bodies, that if there is a foreign body in a wound there is a feeling of sharpness on pressure, that according to the standard of care and her experience as a nurse, she should be aware of the possibility of foreign objects in such a wound.

If the plaintiff's cancer was the result of the nurse's failure to refer him to a physician for examination and treatment during the 10-month period during which she treated him, then it must be acknowledged that a judgment based on malpractice was proper. Employees as well as their employers are responsible for damages due to acts of negligence.

In other than emergency cases where a physician is not present, diagnosis is not a function of professional nursing and treatment by nurses is generally restricted to the execution of orders

given by and under the direction or supervision of a physician. Furthermore, the nurse should only execute legally valid medical orders which she is qualified by training and experience to perform.

Nursing Functions

It is axiomatic that the practice of medicine may not be delegated to nonphysicians. Nevertheless there are numerous traditionally medical functions which are now also performed by nurses under the supervision or direction of a physician and recognized to be nursing functions. Accordingly, under the direction or supervision of a physician, a nurse may administer injections intravenously[5] or intramuscularly[6] or perform x-ray treatments.[7]

Basal metabolism tests, anticoagulant therapy, and the administration of blood transfusions and oxygen are now routinely performed by nurses. The great progress in the science of medicine has led to the delegation of numerous medical procedures to nurses. The first-aid equipment used by the industrial nurse today could have been used only by a physican not too many years ago.

On the other hand the order of a physician purporting to delegate to a nurse the authority to perform an abdominal operation, or an amputation, or to set a fracture or to perform any similar procedure would undoubtedly be considered invalid by the medical and nursing professions as well as the courts. In realistic terms, professional nursing practice includes not only emergency diagnosis and treatment but those medical acts and techniques which are commonly performed by qualified nurses under physicians' orders. Fundamentally, the scope of nursing practice is determined by medical custom. None of the statutes relating to nursing practice attempts to set forth the specific functions of nursing. This satutory flexibility has allowed for the rapid growth of nursing. Consequently the courts have been guided in identifying nursing functions by customs and practices of the medical profession, since physicians can best recognize the proficiency and attainments of nurses.

Emergency Treatment

A medical emergency may be defined as an unforeseen illness or injury which calls for immediate action for the safety of the patient.[8] Anyone, and not necessarily a professional nurse or a physician, may render first aid or perform medical acts to preserve life and limb in the case of an emergency. But one who renders aid in an emergency is under a legal duty to act as a reasonably prudent person. The qualified industrial nurse would generally be held to a greater degree of responsibility and skill than the layman, but to a lesser degree of responsibility than the physician.

Medical custom has permitted a broad definition of the term "emergency" to be applied. It ordinarily refers to situations requiring resuscitative or other first-aid measures. Guiding principles and procedures, approved by a responsible physician, are particularly useful to industrial nurses in such cases.

The case of *Burns v. Bakelite Corp.*[9] is a landmark court decision in the field of industrial nursing. It states the rule that an employer has a duty to provide emergency medical care and other assistance when an employee suffers a sudden illness while engaged in work. The court found that a registered nurse, acting on behalf of the employer, fulfilled this duty but many physicians and nurses may feel that the nursing profession is capable of maintaining a higher standard of performance than that demanded by this court. Because of its basic importance and interest, the holding and facts of the case are stated below in detail.

The plaintiff, who incidentally happened to be a trained nurse, alleged that the negligence of a registered nurse employed by the defendant was responsible for the death of her husband. The trial court judge before whom the case was tried took the case from the jury and rendered judgment himself for the defendant. In a jury case the trial judge is justified in doing this only "if fair-minded men could not differ" in their judgment.

The nurse, Mrs. B———, testified that on a certain morning the plaintiff, Burns, came to the dispensary, pale and perspiring, and she thought he looked ill. He complained of a severe chest pain and thought he had indigestion and he wanted peppermint for it. The nurse took his pulse and his temperature, and found both were normal. He had no difficulty in walking. The nurse suggested he see a doctor, but he refused to see the plant doctor whose office was only about two blocks away, and he asked for his own physician. The nurse tried unsuccessfully to reach the physician by telephone. Then the plaintiff asked her to send him home, and she summoned a car, a station wagon. Refusing assistance, he walked to the car and got in. By the removal of one of the station wagon seats, room could have been made for a stretcher, but the plaintiff was not put on a stretcher.

He was driven by the company's chauffeur to his home. The house was 50 ft. from the roadway, and to reach the front door it was necessary to mount seven steps. The chauffeur opened the door for the plaintiff and he got out and

without aid walked to the house and climbed the stairs.

The nurse contacted the plaintiff's doctor soon after the plaintiff had left the plant but he was engaged in an operation and sent a colleague. The doctor gave a diagnosis of coronary occlusion. He was taken to a hospital where, six days later, he died. The opinion of the court states:

> Generally, no duty rests on an employer to provide medical service or care for an ill or injured employee. Yet when the employee, while engaged in the work of his master, suffers a sudden illness that renders him unable to provide for his own care, the employer must put in his reach such medical care and other assistance as the emergency thus created may in reason require. The duty arises out of necessity . . .
>
> The symptoms that the nurse observed were typical of the onset of a heart attack, although they might indicate acute indigestion or some other condition. But a physician would probably have made a tentative diagnosis of a "coronary occlusion" because that is the most common cause of such symptoms. Based on that diagnosis, the standard emergency treatment would have been the administration of morphine to relieve the pain, not only for the patient's immediate ease but because the pain causes reactions in the heart that increase the damage to that vital organ. And the patient should not be permitted to walk or to make avoidable physical effort. But Mrs. B——— is not a physician; she did not realize that Burns was suffering from a coronary thrombosis; she only knew he was ill and he did not appear to her to be seriously ill. Even if the nurse had made a diagnosis of heart attack, she was not authorized to administer morphine, for such drugs are administered only after the direction of a licensed physician. . . .
>
> There is no negligence indicated by Mrs. B———'s failure to recognize the particular ailment from which Burns was suffering. But should the various symptoms that she observed and that we have recited have warned her it was dangerous to allow Burns to be taken home in the station wagon? If so, there was a failure to exercise due care. If fair-minded men, after carefully considering the facts, could differ in their answer, then the question should have been left to the jury. . . . Run over the facts again—face pale, perspiring, severe pain in chest, pulse and temperature normal, walked without difficulty; the man himself thought he had indigestion; the nurse thought he looked ill, but not very ill. In our opinion, there was nothing to suggest that he was a stretcher case, or that there was need for other means than those employed, or for more care than was exercised in sending decedent home. We find no error in the award of judgment to defendant.

The significance of the case is that it recognizes the duty of the industrial nurse to make a tentative diagnosis of the patient's condition. The nurse was not held to the standards of diagnosis required of a physician, although the court felt that the symptoms were such that a physician would probably have made a tentative diagnosis of a heart attack. Actually, many industrial nurses would probably have suspected the symptoms in the case as common symptoms of a heart attack.

Summary

The profession of nursing is a dynamic discipline which embraces an ever-increasing number of functions. Nurses, particularly those employed in industry, should be careful to limit their diagnostic and therapeutic activities to emergencies and to avoid continued treatment of a patient unless such treatment involves the carrying out of the specific orders of a physician who is in charge of the case.

Under the direction or supervision of physicians, nurses are performing as nursing practice numerous procedures which were formerly performed exclusively by physicians. The limitations on the procedures which a nurse may properly perform are governed by (*a*) the nature of the relationship between the medical and nursing professions in the community, (*b*) the scope of training offered in recognized nurses' training schools, and (*c*) the training, experience, and proficiency of the individual nurse.

In emergency cases, industrial nurses have a duty to determine the need for prompt medical attention, to make a tentative diagnosis of the patient's condition, and to employ necessary resuscitative and first-aid measures.

References

1. *Browning v. Hoffman*, 90 W. Va. 568, 111 S. E. 492 (1922).
2. *Parrish v. Clark*, 107 Fla. 598, 145 So. 848 (1933).
3. *George v. U. S.*, 101 F. Supp. 830 (1951).
4. *Cooper v. National Motor Bearing Co.*, 136 Calif. 229, 288 P. 2d 581 (1955).
5. *General Benevolent Assn. Inc. v. Fowler*, 210 Miss. 578, 50 So. 2d 140 (1951).
6. *Thomas v. Virginic Mason Hospital*, 153 Wash. 297, 277 Pac. 691 (1929).
7. *Wood v. Miller*, 158 Ore. 444, 76 P. 2d 963 (1938).
8. *Broz. v. Omaha Maternity & General Hospital Assn.*, 96 Neb. 648, 148 N. W. 575 (1914). *Trask v. Dunnigon*, 299 S. W. 116 (1927).
9. *Burns v. Bakelite Corp.*, 17 N. J. Super. 441 (1952).

Topical Review

BERYLLIUM DISEASE

A REVIEW OF CURRENT KNOWLEDGE

Harriet L. Hardy, M.D., and Lloyd B. Tepper, M.D., Boston

ALTHOUGH there is no dearth of recent literature on beryllium disease and the toxicology of beryllium compounds, a review at this time may be of importance for a variety of reasons to the physician concerned with occupational illness. Fundamental is the fact that the disease continues to be diagnosed in new cases, although the hazardous etiologic exposures were generally concluded more than a decade ago. This delay in the onset of clinical symptoms gives one good reason to believe that other cases are overlooked because such potentially harmful beryllium exposure is not suspected or revealed even on detailed questioning. A review is presented for the additional reason that patients with chronic beryllium disease are not in all instances receiving the active therapy which present knowledge suggests is the best yet available. Furthermore, it appears that the increasing military and industrial demand for beryllium will be accompanied by an increase in the number of workers who may be subjected to possibly hazardous exposures to toxic compounds of this element.

History

Acute respiratory tract disease due to beryllium compounds was reported as early as 1933 in German workers engaged in the extraction of the metal from its ore, beryl. Two years later Fabroni described a disease in experimental animals exposed to beryllium compounds, and in 1936 Gelman,[1] in describing the Russian experience with the disease, recognized its presence in plant watchmen whose posts were more than 100 meters from any beryllium operation. Additional reports from Russia and Germany followed but generally escaped American interest. When considered, the toxicity of beryllium compounds was largely attributed to the anion involved rather than to the beryllium itself.

In 1941, Massachusetts tuberculosis sanatoria admitted the first fluorescent-tube workers disabled by a pulmonary disease which appeared on chest x-ray films as a fine bilateral miliary mottling suggestive of miliary tuberculosis.[2] When this diagnosis had been ruled out, it was felt that these persons had sarcoidosis, although it was considered odd that all 14 patients whose cases had been reported by 1944 had worked in the same industry.

The suspicion that this so-called "Salem sarcoid" was due to exposure to beryllium-containing phosphors was intensified when the late Dr. Leroy U. Gardner recognized its similarity to the illness in six foundry workers about whom he had been consulted as early as 1938. A subsequent investigation revealed that the involved foundry had been working with beryllium-copper alloys since 1932.

In 1945, Van Ordstrand and his associates[3] described their five-year experience with an acute yet transient pneumonitis in Ohio workers engaged in extracting beryllium from beryl. One year later Hardy and Tabershaw[4] reported in detail the Massachusetts experience with chronic disease in fluorescent-lamp workers. Since then, illness of an acute ("Ohio") or chronic ("Massachusetts") form has been reported from a variety of industries; beryllium and its compounds have been the common denominator among them.

As of Jan. 1, 1959, the Beryllium Registry at the Massachusetts General Hospital, Boston, has accepted 604 cases of beryllium disease from the larger number of suspected cases submitted. Of these 604 cases, 61% have been of the chronic illness. Previously unrecognized

Dr. Hardy is Associate Physician in charge of Occupational Medical Clinic, Massachusetts General Hospital, and Dr. Tepper is Fellow in Occupational Medicine, Department of Preventive Medicine, Harvard Medical School.

From the Massachusetts General Hospital. Some of the work reported was supported by a grant from the National Institutes of Health, Research Grants Division (No. 3812), and some by the Division of Biology and Medicine of the Atomic Energy Commission.

cases, though few in number, continue to be reported.

Uses of Beryllium

The physician is hindered in diagnosing chronic beryllium disease by the fact that the worker-patient frequently does not know the nature of the materials with which he or those around him have worked. Furthermore, this work exposure may have terminated more than a decade prior to the onset of current clinical symptoms.

Toxic beryllium exposure must be considered when a variety of occupational histories are related (Table). Although there have been no reports of beryllium disease in miners of the ore, beryl, which contains from 2% to 12% beryllium, the subsequent extraction process has been frequently implicated in the disease. The manufacture of fluorescent tubes constituted a second major source of toxic exposure in that phosphors used from 1938 to 1949 often contained from 2% to 14% beryllium, generally as zinc-manganese-beryllium silicate. This hazardous use of beryllium was discontinued in 1949 by mutual agreement of the manufacturers. No such self-regulation has applied to the "neon" sign producers, many of whom operate small backyard or garage "factories" and who may freely obtain and process beryllium oxide in the preparation of phosphors.

Any operation in which beryllium alloy particles fine enough to reach the lower respiratory tract are generated is potentially hazardous. Chronic beryllium disease has been reported in two cases when this element constituted not more than 2% of a copper alloy.[5]

Beryllium is used in windows of x-ray tubes because it is easily penetrated by the rays and is stable at high temperatures. It is also employed in nuclear energy projects, since it readily yields neutrons under alpha particle bombardment. The oxide is a superior refractory ceramic and finds use in crucibles and special refractory bricks. Beryllium disease has been reported in each of these industries.

Because of its lightness, rigidity, and resistance to heat, beryllium is today finding use in structural parts of high-velocity space vehicles. The oxide may be used in heat-resistant ceramic nose-cones. Though this defense production is carried on under strict industrial hygiene supervision, the physician caring for the involved workers must remain alert for evidence of beryllium disease, which, fortunately, has not been observed.

It is to be emphasized that typists, clerks, engineers, and janitors, though they do not directly use beryllium, may be affected because of atmospheric contamination. Furthermore, neighborhood atmospheric contamination or beryllium-containing dusts brought home on work clothes may lead to disease in persons remote from any plant.

Operations Incriminated in Beryllium Disease

Beryllium extraction operations
Fluorescent lamp phosphor manufacturing
Fluorescent lamp manufacturing
Fluorescent lamp salvage
"Neon" sign manufacturing
Beryllium metallurgical operations
Beryllium alloy manufacturing
Fabrication and machining with beryllium alloys
Beryllium oxide ceramic manufacturing
X-ray and radio tube manufacturing
Atomic energy projects

Clinical Beryllium Disease

The clinical syndromes associated with toxic beryllium exposure can be readily divided into two categories: acute and chronic. Though they can be separated in terms of a duration of less than and more than one year, respectively, the dissimilarity between the two groups is evident in the clinical pictures presented, although these themselves vary widely. The acute illness may progress to the chronic form with or without additional exposure, but this course has been definitely documented in only 28 patients.

Acute Beryllium Disease—Acute beryllium disease,[3] most frequently related to intense but brief toxic exposure, consists of variable upper or lower respiratory tract irritation, dermatitis, and/or conjunctivitis. The respiratory tract symptoms range from a mild nasopharyngitis or tracheobronchitis to a severe chemical pneumonitis with a case fatality rate of about 10%. The pneumonitis has usually appeared within 72 hours after heavy exposure, but an insidious form may be delayed for several weeks after a less intense but prolonged exposure. There is a rarely productive cough, anorexia, progressive dyspnea, and chest pain or tightness. Cyanosis, diffuse pulmonary rales, and less commonly, pleural rubs may be found. Bilateral haziness, patchy infiltrations, or nodular densities on chest x-rays appear within three weeks after the onset of symptoms, and such changes have been known to persist as long as one year. These persisting x-ray changes have been observed in patients with the mildest of respiratory symptoms. In acute beryllium intoxication clinical recovery is usuallly rapid, within weeks, though the insidious form has been known to last several months.

Beryllium dermatitis may be one of three types: a contact dermatitis, a localized dermal ulceration, or a subcutaneous granuloma. The contact dermatitis is described as an edematous,

papulovesicular, pruritic eruption occurring on the exposed skin surfaces. Ulceration develops only after a particle of a toxic beryllium-containing substance is introduced into an abrasion or laceration. Healing is not readily achieved without the removal of the offending particle by curettage. Cuts with fluorescent tubes may produce subcutaneous granulomata with the histological features of skin sarcoidosis when a beryllium-containing phosphor is introduced into the skin. Such granulomata may not appear for as long as four years[7] following a cut, which, itself, promptly heals. Wide surgical excision of a granuloma results in complete healing.

Chronic Beryllium Disease — Chronic beryllium disease was described in 1946 by Hardy and Tabershaw[4] under the diagnostic title of delayed chemical pneumonitis. Since that time 384 cases with 121 deaths (31%) have been reported to the Beryllium Registry. Its clinical character differs from that of the acute disease in that it is of longer duration, may progress in spite of the cessation of toxic exposure, may have widespread systemic manifestations, and may not appear until an "incubation period" of up to 15 years has elapsed. About 70% of the cases in the Registry, however, have shown evidence of clinical disease within five years of the termination of exposure.

Such exposure has in most cases exceeded two years' duration, but chronic illness has apparently followed an exposure of less than six hours. Commonly the disease has been precipitated or, if already manifest, exacerbated by stresses such as pregnancy, surgery, or viral respiratory infections or by the inhalation of irritant fumes other than toxic beryllium compounds.

Although the disease may be rarely asymptomatic and evidenced only by abnormalities on chest x-ray films, it frequently involves several organ systems. The respiratory tract is involved at some time in the course of the disease, generally with a pneumonitis causing dyspnea, a usually nonproductive cough, and pleuritic pain. With this picture may be seen tachypnea at rest, cyanosis, and digital clubbing, although auscultatory chest signs may be minimal, transitory, or patchy. Bronchospasm is not typical. With progressive pulmonary disease pulmonary hypertension with resultant cor pulmonale and myocardial decompensation may complicate the picture.

The disease may involve the liver, producing enlargement and laboratory evidence of hepatic dysfunction. The spleen may also be enlarged. There is biopsy and autopsy evidence of granulomatous involvement of these organs, the kidneys, lymph nodes, myocardium, and striated muscle. Convulsions, hyperactive reflexes, and extensor plantar reflexes in conjunction with radiographic evidence of a space-occupying cerebral lesion have been observed in two cases of chronic beryllium disease. Granulomatous changes in the central nervous system therefore have been suspected, although the opportunity for pathology examination in these cases has been denied.

Substantial weight loss may be dramatic at the onset of beryllium disease and in a group of beryllium-exposed workers has been used as an indication of beryllium effect. Negative nitrogen balance was described by Waterhouse[8] as a part of beryllium disease. A markedly disturbed serum protein distribution with an elevation of gamma globulin is frequently observed. A negative calcium balance unrelated to steroid therapy or immobilization and disuse has also been observed, and some 10% of the patients chronic with disease have developed renal stones. Hypercalciuria has been demonstrated in many of these patients and in others without stone.

Evanescent beryllium-containing skin nodules having the characteristics of sarcoidosis have been observed, and in at least one case under steroid therapy the reappearance of these nodules on three occasions has heralded the recrudescence of pulmonary symptoms. Other patients have described migratory joint symptoms similar to those of rheumatoid arthritis. These complaints have been ameliorated with salicylates or adrenal corticosteroids.

Spontaneous pneumothorax has been a complication in about 12% of the patients with chronic disease and has been the immediate cause of death in at least two of them.

As far as is known, the ocular, parotid, tonsillar, and cystic bone changes of sarcoidosis are not seen in chronic beryllium disease.[9]

The chest x-ray findings in this disease are not specific, and wide variations have been observed. A unique "sandstorm" has been described[10] in early chronic pulmonary disease, but the commoner diffuse, bilateral, miliary nodulation may be easily interpreted to be tuberculosis, sarcoidosis, carcinomatosis, pulmonary mycosis, or another miliary pulmonary disease. Emphysematous blebs or a pneumothorax may be seen, and hilar exaggeration is common.

Tuberculosis in patients with chronic beryllium disease has been conspicuously rare, particularly in view of widespread steroid therapy and hospitalization in tuberculosis sanatoria. Not more than four persons have been reported with active pulmonary tuberculosis, although a fourth of the patients with chronic disease have positive tuberculin reactions. Cancer has been similarly rare.

In those cases in which the diagnosis of chronic beryllium disease remains uncertain on clinical or epidemiological grounds, quantitative assays for tissue beryllium have been helpful. Some students of this disease, however, have accepted the diagnosis even in the face of negative tissue assays. Such negative reports may be dependent on the difficulties in detection of small amounts of beryllium in biologic material.

The skin test of Curtis,[11] if positive, supplies corroborative evidence of beryllium disease. Because beryllium has been shown to be a sensitizing agent, positive tests may be observed in persons so sensitized but without evidence of beryllium disease. In at least two Registry cases of biopsy-proved beryllium disease (characteristic histopathology and significant beryllium assays) the skin test has been negative.

Pulmonary function studies[12] have shown the basic lung physiological defect to be an impaired diffusion of oxygen from inspired air into the minute pulmonary vasculature. This alveolar-capillary block is shown by increased gradients of oxygen partial pressure across the involved membrane and deficient oxygen content (unsaturation) of the arterial blood. As might be expected with progressive fibrosis, the stiffening of the lung tissue gives rise to ventilatory defects which are not evident early in the disease.

The Neighborhood Cases—The 44 recognized neighborhood cases of beryllium disease constitute a remarkable group in that their case fatality rate (54%) is higher than that in any occupational group. Almost all the patients either lived within the vicinity of a plant discharging air-borne beryllium compounds or came into contact with dust-covered clothes brought home by beryllium workers. Twenty-one of these patients could describe as their only source of exposure residence in the vicinity of such a plant. The high case fatality rate in these patients is probably misleading; there is reason to believe that the milder cases have been largely overlooked or misdiagnosed because of the remote relationship to beryllium-using operations.

On the other hand, it is not inconceivable that some of these people were unusually vulnerable to toxic beryllium compounds. It is furthermore possible that the responsible compounds themselves, by virtue of chemical or physical characteristics, were unusually toxic. Such vulnerability or such characteristics have not been demonstrated.

Pathology—The pathology picture of acute beryllium pneumonitis in those few cases examined has been characterized by an acute inflammatory reaction with a fibrinoid alveolar exudate containing numerous mononuclear cells, capillary engorgement, and occasional focal hemorrhagic extravasation. The typical lesion of the chronic disease is a noncaseating pulmonary granuloma the appearance of which is such that there is dispute among experienced pathologists as to whether or not it can be distinguished from the changes seen in sarcoidosis. There is a diffuse septal thickening with interstitial collections of mononuclear and giant cells and amorphous debris. Fibrosis may be minimal or may predominate over the granulomatosis. Involvement of spleen, liver, kidney, lymph nodes, myocardium, and striated muscle has been reported.

The osteosclerosis[13] observed in rats and rabbits following the parenteral injection of beryllium compounds has not stimulated a systematic pathology study of bone in human cases. There have been a few instances of increased bone density in patients, but a review of bone films has not yielded evidence of general osteosclerosis. Neither the osteosarcomas[14] nor the pulmonary tumors observed in certain beryllium-exposed animals have appeared in humans. Experience thus far has revealed only one case each of bronchiogenic and alveolar-cell carcinoma in chronic beryllium disease patients.

Correlations between the quantity of tissue beryllium and the extent of tissue alteration have not been established.

Therapy—Although there is as yet no specific therapy for beryllium disease, the introduction of the adrenocorticotrophic hormone (corticotropin, ACTH) and the adrenocortical steroids into clinical medicine has given the physician a potent agent for its control. Prior to their use the treatment of chronic beryllium disease was entirely symptomatic and based upon the use of oxygen and bed rest. The relief offered was transient, and there was no apparent alteration in the course of the disease.

The introduction in 1950 of corticotropin and shortly thereafter of the adrenal steroids has been accompanied by both subjective and objective clinical improvement in patients with chronic beryllium disease. Pulmonary alveolar-capillary oxygen gradients have diminished under this therapy, and there have been almost spectacular restorations of myocardial compensation in cases with evidence of well-established cor pulmonale.

Previously abnormal serum protein distributions and urinary calcium levels have become normal in studied cases of beryllium poisoning with adequate steroid treatment.

Chest roentgenograms in at least two instances have shown complete clearing which persists when therapy is stopped; more frequently definite abnormalities, though usually

lessened, do persist. A curious phenomenon has been observed following the institution of corticoid therapy in some patients in that their chest films clear markedly, then regress almost to the pretreatment status, and subsequently show varying degrees of improvement, though all this while the patient has made steady clinical gain without correlation with the fluctuating x-ray picture.

That steroid therapy is no "cure" is to be seen in the relapses which may follow premature cessation of treatment. Ferris[15] has made the somewhat discouraging observation that, in spite of continued steroid therapy, the alveolar-capillary oxygen gradient may begin to creep upward again after a period of definite improvement with reduction in the gradient. Long-term steroid therapy, in some cases longer than five years, has been required because of the persistence of signs and symptoms of beryllium intoxication.

If there is objective evidence of disturbed body functions in beryllium disease, the evidence is adequate that steroid therapy represents the best presently known course of action. Though well-known risks accompany the use of steroids, the risks associated with neglected or undertreated chronic beryllium disease are greater by far. Reported steroid side-effects in this disease have been limited to rare gastritis without demonstrable ulceration and a few instances of transient glycosuria. Seeler[16] has reported that the only deaths from this disease in steroid-treated patients have occurred when the disease was far advanced at the institution of this therapy. The currently reported maintenance prednisone dosages are generally within the range of 15 to 20 mg daily.

When indicated, oxygen may be used freely in these patients, for it is not dangerous as it is in emphysema or other diseases of alveolar hypoventilation. Arterial carbon dioxide tension is normal or even reduced in chronic beryllium disease.

The need for effective and safe specific therapy in beryllium intoxication is reflected in recent studies of chelating agents. Aurintricarboxylic acid, an effective agent in experimental acute intravenous beryllium poisoning, continues to be evaluated.[17] More recently Cash and his associates[18] have reported an increased urinary excretion of beryllium in chronically poisoned patients when either trisodium monohydrogen EDTA or calcium-disodium EDTA is administered. The side-effects and clinical usefulness of these materials remains to be more completely evaluated.

Prevention—Prevention of beryllium disease lies in the control of atmospheric contamination by particles of toxic respirable material. The substitution of halophosphates for beryllium-containing phosphors was a major step in this direction.

When the element cannot be excluded from essential operations, control becomes dependent upon industrial hygiene engineering and medical supervision of workers. On the basis of animal studies and known human experience, the value of 2μg per cubic meter of air has been suggested as safe for long-term exposure. There have been no reports of disease at this level of exposure during the 10 years it has been used. In-plant control must not be achieved at the cost of neighborhood contamination; careful recovery of toxic materials and appropriate stack design are essential.

Medical supervision of workers requires that those persons with previous beryllium disease, other chronic respiratory illness, or abnormal chest x-ray findings be excluded from beryllium operations. The preplacement examination should include a 14 $\times$ 17 chest x-ray film so as to establish a base line against which subsequent changes, if any, can be compared. Routine "berylliosis examinations" have been of little help in the control of beryllium disease, and special examinations are probably indicated only after known overexposures or in the event of clinical complaints or weight loss. The regular annual medical examination is desirable, however, and respiratory illness should be gone over in considerable detail. The determination of vital capacity is of no value in the control of chronic beryllium disease, for a ventilatory defect in this illness is generally not demonstrable until the lung is markedly fibrotic and stiffened. As beryllium disease may be related to a hypersensitivity to the element, and since the beryllium patch test may produce sensitivity or, as has been suggested, disease manifestations in already sensitized persons,[6] it is unwise to use this test in screening procedures.

Conclusions

It is to be emphasized that beryllium disease is a systemic intoxication and not a pneumoconiosis. The final word regarding its clinical character, course, prognosis and treatment has not been said, and new data are constantly being collected. The diagnosis of beryllium poisoning rests upon the establishment of beryllium exposure, the presence of beryllium in body fluids or tissue, and the demonstration of consistent histopathological findings. The clinical and radiologic pictures are so protean that they, together with the beryllium patch test, supply corroborative rather than diagnostic evidence.

Because of the delay in the onset of beryllium disease after exposure and as a result of

the expanding uses of beryllium and its compounds, physicians concerned with occupational etiologies need to remain aware of the causes, course and therapy of this granulomatous man-made disease.

Dr. Hardy's address is Massachusetts General Hospital, Boston 14.

References

1. Gelman, J. G.: Poisoning by Vapors of Beryllium Oxyfluoride, *J. Indust. Hyg. & Toxicol.* 18:371, 1936.

2. Shipman, T. L.: History of the Beryllium Problem, in Pneumoconiosis, edited by A. J. Vorwald, New York, Paul B. Hoeber, Inc. (medical book department of Harper & Brothers), 1950, Chap. 1.

3. Van Ordstrand, H. S.; Hughes, R.; DeNardi, J. M., and Carmody, M. G.: Beryllium Poisoning, *J. A. M. A.* 129:1084, 1945.

4. Hardy, H. L., and Tabershaw, I. R.: Delayed Chemical Pneumonitis Occurring in Workers Exposed to Beryllium Compounds, *J. Indust. Hyg. & Toxicol.* 28: 197, 1946.

5. Sneddon, I. B.: Berylliosis: A Case Report, *Brit. M. J.* 1:1448, 1955.

6. Grier, R. S.; Nash, P., and Freiman, D. G.: Skin Lesions in Persons Exposed to Beryllium Compounds. *J. Indust. Hyg. & Toxicol.* 30:228, 1948.

7. Lederer, H. E., and Savage, J.: Beryllium Granuloma of the Skin, *Brit. J. Indust. Med.* 11:45, 1954.

8. Waterhouse, C.; Keutmann, E. H.; Howland, J. W., and Brure, R. A.: Metabolic and Cardio-Respiratory Studies on Patients with Beryllium Granulomatosis, University of Rochester Atomic Energy Project, UR-101, 1949.

9. Hardy, H. L. Differential Diagnosis Between Beryllium Poisoning and Sarcoidosis, *Am. Rev. Tuberc.*, 74:885, 1956.

10. Wilson, S. A. Delayed Chemical Pneumonitis or Diffuse Granulomatosis of the Lungs due to Beryllium, *Radiology* 50:770, 1948.

11. Curtis, G. H. Cutaneous Hypersensitivity Due to Beryllium, *Arch. Dermat. & Syph.* 64:470, 1951.

12. Ferris, B. G., Jr.; Affeldt, J. E.; Kriete, H. A., and Whittenberger, J. L.: Pulmonary Function in Patients with Pulmonary Disease Treated with ACTH, *A. M. A. Arch. Ind. Hyg.* 3:603, 1951.

13. Scott, J.: The Experimental Production of Tolerance and Osteosclerosis by Repeated Intravenous Injections of Beryllium Sulphate, University of Rochester Atomic Energy Project, UR-125, 1950.

14. Dutra, F. R., and Largent, E. J.: Osteosarcoma Induced by Beryllium Oxide, *Am. J. Path.* 26:197, 1950.

15. Ferris, B. G., Jr.: Pulmonary Function in Patients with Beryllium Intoxication, *A.M.A. Arch. Indust. Health* 19:146, 1959.

16. Seeler, A. O.: Treatment of Chronic Beryllium Poisoning, *A.M.A. Arch. Indust. Health* 19:164, 1959.

17. Schubert, J., and Rosenthal, M. W.: Chemical Approaches to the Treatment of Beryllium Poisoning, *A.M.A. Arch. Indust. Health* 19:169, 1959.

18. Cash, R.; Shapiro, R. I.; Levy, S. H., and Hopkins, S. M. Chelating Agents in the Therapy of Beryllium Poisoning, *New England J. Med.*, to be published.

5TH INDUSTRIAL HYGIENE CONFERENCE

on

HEALTH ENGINEERING IN THE SPACE AGE

at

THE UNIVERSITY OF TEXAS

Austin, Texas

MAY 8, 1959

The Conference will be sponsored by the Occupational Health Division, Texas State Department of Health; the College of Engineering, The University of Texas; the North Texas Section, American Industrial Hygiene Association; and the Gulf Coast Section, American Industrial Hygiene Association.

Topical Review

Noise and Hearing Loss

II. RECOGNITION OF THE HAZARD

Lieut. Cmdr. Norbert E. Rosenwinkel (MC), U.S.N., Kenneth C. Stewart, M.S., and Leo G. Doerfler, Ph.D., Pittsburgh

This is the second of a series of six reviews dealing with noise and its effect upon hearing. Subsequent installments are scheduled to appear at intervals of three months.

DESPITE the fact that noise-induced hearing loss is considered by many as being a fairly recent development due to modern industrial processes, the entity has been recognized for centuries. Ramazzini noted deafness in millers which he attributed to the noise of the mill causing a loss of tonus of the tympanic membrane. Kryter[1] points out that Fosbrooke speaks of "old" and "modern" discussants on the subject in 1831!

The older authors directed their main concern toward workers in the metal working trades, such as blacksmiths and coppersmiths, and, using clinical tests for deafness, reported significant percentages of workers in these trades as being deafened. Thompson[2] in his text published in 1914, cites a number of studies by Gottstein and Kayser, Holt, and Barr and Habermann which showed a keen awareness of the magnitude of the problem. It is interesting to note that these same studies are again quoted with few additions by Blake in Kober and Hayhurst's text[3] in 1924, and by McCord, Teal and Witheridge[4] in 1938, which is indicative of some lack of interest in the problem until rather recently.

By 1930, electric audiometry had become available as a tool in assessing the hazard of noise-induced hearing loss. In a pioneering effort, the New York State Department of Labor[5] embarked on a study to determine the prevalence of this condition, utilizing the audiometer.

The survey covered 1,040 workers employed in seven industrial plants, ranging from a commercial bakery to a can-making plant, with two large offices to serve as controls. The hearing of the employees was reported only as "normal" or "deafened" in those cases in which hearing losses greater than 10 sensation units were noted. The group which was classified as "deafened" was further subdivided into those with and those without preexisting pathologic ear conditions which might have contributed to the deafness. The results indicated a progressively increasing proportion of "deafened" individuals with no history of previous "ear conditions" with increased intensity of noise in the workroom and length of service of the worker.

The last two decades have shown an accelerating upsurge in interest in the occupational deafness problem as reflected in published reports of surveys of occupational groups throughout the world. Larsen[6] found that of his series of 123 shipyard and factory workers 50% had deficient hearing on tests for whispered voice and audiometric testing. McCoy[7] followed a group of men attending a "chipping" school who had normal hearing at the start of their training course. Hearing losses became manifest after seven hours, one month, and one year of exposure to noises ranging up to intensities of 130 db.

Other studies have followed which have confirmed the presence of hearing loss for high frequencies after exposure to noise. Gardner,[8] Johnston,[9] Cox and associates,[10] Fox,[11] and Bostic[12] are among those who have reported results of audiometric examinations upon various

Lieut. Cmdr. Rosenwinkel (M.D., Dr. P.H.) is Head, Industrial Medicine Division, Norfolk Naval Shipyard, Portsmouth, Va. Mr. Stewart is Assistant Professor of Industrial Hygiene, Graduate School of Public Health, University of Pittsburgh, and Dr. Doerfler is Professor of Audiology and Director of the Department, School of Medicine, University of Pittsburgh.

The opinions or assertions contained herein are the private ones of the authors and are not to be construed as reflecting the views of the Navy Department or the naval service at large.

occupational groups which have demonstrated loss of hearing after exposure to assorted industrial noises.

The Effects of Noise

Nonauditory effects—Although the question of nonauditory effects of noise is beyond the scope of this present discussion, a résumé of prevailing opinion may give a more complete appreciation of the ramifications of the noise problem. It is actually quite logical that industry concern itself with these general effects of noise, and, in fact, such a concern did manifest itself before the present burgeoning interest in occupational deafness.

It is quite generally accepted that excessive noise (more accurately, unwanted sound) is apt to prove annoying and actually deleterious to the performance of people engaged in tasks which require concentration, coordination, and/or great skill. When one attempts to synthesize an informed opinion on the subject from the extant literature, one becomes aware of the amount of confusion, not to mention conflicting and mutually exclusive conclusions reached by investigators of the problem. Fortunately, Kryter[1, 13] and Sataloff[14] have critically evaluated and summarized the prevailing expert opinion on this subject. It is generally agreed that the large psychological areas in which excessive sound may exert some deleterious effect are work performance, including communications, and emotional reaction, "annoyance," in response to sound.

Work performance has been studied in a number of field and laboratory studies investigating such factors as reaction time, learning ability, performance or intelligence tests, and performance of psychomotor tasks such as typing, aiming of guns, and operation of machinery in which some motor skill is involved. In general, the majority of experiments have shown only slight, if any, deleterious effects of noise on work performance. Indeed, some tasks showed an improvement in performance under noisy conditions. Authorities hasten to caution against the drawing of far-reaching conclusions in the latter case until further substantiating evidence is produced.

When the field of communication is examined, fairly precise methods are available for evaluating the effect of noise on speech communications. However, while such methods are useful and informative to the communication engineer, they do not furnish information relative to the relationship of work performance to efficiency in communication. Nevertheless, Kryter[13] concludes that "the direct and indirect effects of industrial noise on communication are the major detrimental effect (other than deafness) that can be attributed to noise and that the control of noise with respect to the need for communications would in many cases effectively increase work output, job satisfaction, etc."

The sphere of emotional reaction to excessive noise is the least exact and accessible to evaluation of all of the areas of the effect of sound. Noise can no doubt be "annoying," but, as Sataloff points out, annoyance, is a difficult concept to standardize. It has been found that pitch, loudness, and modulation of the two are related to the annoyance of a noise. Fortunately, most persons adapt to loud noise with respect to their productive abilities. The responses of workers, both solicited and unsolicited, have indicated fatigability, irritability, "nervousness," and job dissatisfaction as being among the commoner reactions to noisy work situations.

Students of the question have resorted to a variety of objective physiological measurements in an attempt to evaluate emotional reactions. These measurements include pulse and respiratory rate, blood pressure, basal metabolism, visual acuity, electrocardiogram, electroencephalogram, urinalysis, kidney function, galvanic skin response, and muscular tonus. These parameters all return to normal limits in the presence of continuous repetition of sounds.

It must be emphasized that excessive noise as used in the past paragraphs refers to levels below the threshold of sensation. Furthermore, it should be pointed out that it is probable that past experiments have not reflected the full impact of noisy environment on industrial workers and that further studies are necessary to either confirm or correct the inconclusive results thus far obtained.

Auditory Effects—Modern civilization has probably created the problem of acoustic trauma and loss of hearing due to noise. Especially in the industrial setting, personnel are exposed almost continuously to a clamor which has no equivalent in nature. As has been cited, evidence is plentiful that lasting injury to hearing occurs as a result of repeated exposure to noise even though the exact relationship of loss of hearing to excessive acoustic stimulation is obscure.

Certain intrinsic defensive mechanisms are available which are probably adequate to protect the ear in noisy situations which occur in nature, e.g., falling trees, avalanches, earthquakes, waterfalls, and the like. Kobrak [15] considers that there are four such mechanisms: (*a*) the acoustic reflex of the stapedius and tensor tympani muscles, (*b*) alteration of the vibratory response of the stapes, (*c*) the position of the oval and round windows, and (*d*) auditory adaptation.

The essential features of the muscles of the middle ear have been discussed before. The contraction of these muscles occurs as a reflex response to acoustic stimulation. It has been found on animal experiments that contraction occurs after a short latent period provided the stimulus exceeds a threshold value. The magnitude of the response, i.e., the strength of contraction, is directly related to the intensity of the stimulus.

Furthermore, the contraction is tetanic and will increase or decrease with modulation of the intensity of the stimulating tone. The effect of contraction of these muscles is to dampen the vibration of the ossicular chain in transmitting strong vibrations. Two defects (if this term is applicable) appear in the protection afforded by this mechanism. First, the latent period of about 10 milliseconds is sufficiently long that many of the extremely loud transient noises met with today have already attained maximum intensity and are decaying before the muscles begin to contract. Secondly, the muscle reflex cannot maintain itself indefinitely in the face of continuous loud sounds such as are met in many manufacturing processes. In the face of such continuous insult, the reflex is soon fatigued and the ear is left unprotected.

The oscillation of the stapes is the mechanism by which sound vibrations are transmitted through the oval window into the middle ear. The normal mode of this action has been likened to a door swinging on its hinges or the toe tapping the floor. Kobrak confirmed von Békésy's observation that under strong stimulation the stapes may alter this usual motion and begin to vibrate about its long axis, bringing about a considerable decrease in the efficiency of the transfer of energy into the inner ear.

The third protective mechanism is operative only after considerable damage has already been done to the ear. It has been mentioned that the ossicular chain operates as an impedance-matching mechanism preferentially conducting sound to the foramen ovale. With motion of the oval window the energy is conducted through the fluid column of the cochlea to the round window, which executes movements which are identical with those of the oval window but opposite in phase. If the ear be posed to a stimulus intense enough to cause disruption of the tympanic membrance and/or the ossicular chain, this conduction mechanism no longer functions. The sound energy impinges on the two windows simultaneously and for all practical purposes with the same phase. This condition is incompatible with good hearing but does reduce the amount of energy delivered to the inner ear, reducing the hazard of cochlear damage. As can be appreciated, this circumstance can be considered as protective only in the broadest sense of the term.

Auditory adaptation is a poorly understood mechanism. The term is applied to the physiological diminution of sensory response to sustained acoustic stimuli.

The fact that the natural protective mechanisms of the ear are of no avail in the artificially noisy environment of our industrial civilization is borne out by the references cited as well as others. Although the old terms of "boilermaker's deafness" and "artillerist's deafness" have given way to the more sophisticated occupational or industrial deafness, knowledge of the deleterious effects of man-made noise long antedated the advent of the electrical audiometer and noise level meter.

The first effect of excessive acoustic stimulation is a transient auditory fatigue resembling to an exaggerated degree the psysiological fatigue of the ear in response to ordinary sounds. Presumably McCoy's[7] chippers, who showed an average depression of 50 db after seven hours' exposure to over-all levels of 120 to 135 db, showed such a phenomenon. This suppression of hearing acuity is greater for the higher frequencies, being centered about 4000 cps. The duration of these transient effects is not known with any degree of certainty, but recovery does begin upon cessation of the stimulus.

Ireland[16] suggests that the recovery time is approximately the square of the duration of stimulation. Sataloff[14] states that no significant auditory fatigue remained in subjects exposed to jet engine noises 15 minutes after they were removed from the noise field. Despite assertions that some amount of temporary loss may persist for months following exposure, Kobrak et al.,[17] Cox et al.,[10] and others have shown that for practical purposes the major portion of ultimate recovery is attained in a matter of hours to days.

What the organic changes are that produce these transient effects is not known. Possibly they are in the nature of reversible biochemical alterations within the cellular metabolism of the end-cells of the hearing organ. In susceptible individuals, continued exposure to noises of damaging intensity, eventually leads to permanent impairment of hearing, first noted, as in the case of auditory fatigue, at around 4000 c.p.c., the "boilermaker's notch." With continuing insult, the loss is progressive and as time goes on, may involve the frequencies essential for the understanding of human speech, resulting in social and occupational disability for the afflicted person. Authorities in the field are re-

luctant to speculate as to what the ultimate loss of hearing acuity might be with continuing exposure to hazardous noise. One prediction is that the loss due to a given noise exposure would eventually become equivalent to the audiogram of a normal-hearing subject masked by the noise in question. Guild[18] states that as far as he knows acoustic trauma associated with industrial noise has never caused total deafness.

Clinically, hearing loss due to acoustic trauma is a perceptive or nerve type deafness. Typical presenting complaints are the inability to understand clearly high-pitched female voices, inability to follow conversation in a group, and to hear telephones and other ringing signals. Paradoxically, loud noises may become quite bothersome and confusing to persons with perceptive hearing loss. A most annoying sympton to most patients is the tinnitus which is a frequent accompaniment of nerve deafness. Finally, as the loss progresses and the patient hears his own voice less distinctly, he comes to speak with the loud unmodulated voice characteristically associated with the hard of hearing.

It is to be emphasized that changes in hearing sensitivity are measurable on the audiometer long before any subjective appreciation of loss by the patient.

The knowledge of the histopathological lesions of acoustic trauma is based on animal experiments which have been carried on by numerous investigators for years. There has been good agreement as to the essential features of the lesions. Some studies have been carried out on the inner ears of persons who have died of causes not related to the ear. Although it is difficult to obtain noise-exposure data from clinical records, lesions closely resembling those found in animal studies have been noted. There is probably no good reason to doubt that they are the result of acoustic trauma.

The effect of noise trauma on the inner ear is the destruction of the hair cells of the organ of Corti. The earliest damage detectable microscopically is alteration of the staining qualities and swelling of the cells. This progresses to complete destruction of an occasional outer cell at the area of localization of 4000 cps on the basal turn of the cochlea. With continued severe insults, the damage may continue to progress by degrees from the mildest form at the basal turn until the entire cochlea is involved and the organ of Corti is completely disrupted, leaving only the bare basilar membrane.

The reason for the first appearance of damage at the area of 4000 cps has long been a matter of conjecture. Early theories that this particular part of the organ of Corti is relatively ischemic owing to the anatomic features of its vascular supply have not found wide support in more recent years. Hardy[19] suggests that the dip is a matter of increased sensitivity of the ear as evidenced by the velocity amplitude of the basilar membrane for constant energy of stimulation. Rüedi and Fuerer[20] theorize that mechanical trauma caused by eddies in the endolymph damages the cochlea. Finally, Hilding[21] holds that the entrance to the cochlea is so constituted that the force of the sound waves entering the organ impinges with greatest force on the area of localization for 4000 cps.

The diagnosis of hearing loss due to exposure to excessive noise may be quite simple or impossible to make on an individual basis. In general, the earlier the patient is seen in the disease process the easier the diagnosis is to make. Obviously, a confirmed history of exposure to high noise levels is the *sine qua non* of the condition. Serial audiograms of the patient during the course of this exposure are extremely helpful, but, unfortunately, these are generally unavailable in most cases. As the disease progresses, it may become virtually identical from an audiometric point of view with other types of perceptive hearing losses.

The prognosis of the condition is poor as far as hope of recovering any of the lost hearing acuity. The improvement that may become apparent after the removal of the patient from his noisy environment probably represents a superimposed transient auditory fatigue. Once changes occur within the cochlea, the resulting loss of hearing is permanent and irreversible.

Lieut. Cmdr. Rosenwinkel's address is Dispensary, Norfolk Naval Shipyard, Portsmouth, Va.

References

1. Kryter, K. D.: The Effects of Noise on Man. *J. Speech & Hearing Disorders*, Monograph Supplement, No. 1, 1950.

2. Thompson, W. C.: The Occupational Diseases, New York, D. Appleton & Co., 1914.

3. Kober, G. M., and Hayhurst, E. R.: Industrial Health, Philadelphia, P. Blakiston's Son & Co., 1924.

4. McCord, C. P.; Teal E. E., and Witheridge: Noise and Its Effect on Human Beings, *J.A.M.A.* 110:1553, 1938.

5. State of New York, Department of Labor: Effect of Noise on Hearing of Industrial Workers, Special Bulletin No. 166, 1930.

6. Larsen, B.: Investigation of Professional Deafness in Shipyard and Machine Factory Laborers, *Acta Otolaryngol.* (Supp.) 36:3, 1939.

7. McCoy, D. A.: The Industrial Noise Hazard, *Arch. Otolaryngol.* 39:327, 1944.

8. Gardner, W. H.: Injuries to Hearing, *Indus. Med.* 13:676, 1944.

9. Johnston, C. M.: A Field Study of Occupational Deafness, *Brit. J. Indust. Med.* 10:41, 1953.

10. Cox, J. H.; Mansur, R. H., and Williams, C. R.: Noise and Audiometric Histories Resulting from Cotton Textile Operations, *A.M.A. Arch. Indus. Hyg.* 8:53, 1953.

11. Fox, M. S.: Evaluation of Hearing Loss in Drop Forge Workers, *Laryngoscope* 63:960, 1953.
12. Bostic, S. C., and Worsham, H. J.: Hearing and Industrial Noise, *U. S. Armed Forces J.* 69:953, 1954.
13. Kryter, K. D.: Noise and Behavior in the Acoustical Spectrum; Sound—Wanted and Unwanted, Ann Arbor, Mich., The University of Michigan Press, 1952.
14. Sataloff, J.: Industrial Deafness. New York, The Blakiston Division, McGraw-Hill Book Co., Inc., 1957.
15. Kobrak, H. G.: Biophysics of Sound Perception in Regard to Physiology, in the Acoustical Spectrum; Sound—Wanted and Unwanted, Ann Arbor, Mich., the University of Michigan Press, 1952.
16. Ireland, P. E., and Hodges, W. E.: The Problem of Acoustic Trauma, *Canad. M. A. J.* 73:713, 1955.
17. Kobrak, H. G., Lindsay, J. R., and Perlman, H. D.: Experimental Observations on the Question of Auditory Fatigue, *Laryngoscope* 51:796, 1941.
18. Guild, S. R.: Effects of Sound: Pathological—Including Hearing Loss, in the Acoustical Spectrum; Sound—Wanted and Unwanted. Ann Arbor, Mich., The University of Michigan Press, 1952.
19. Hardy, H. C.: Tentative Estimate of a Hearing Damage Risk Criterion for Steady-State Noise, *J. Acoust. Soc. America* 24:756, 1952.
20. Rüedi, L., and Fuerer, W.: Physics and Physiology of Acoustic Trauma, *J. Acoust. Soc. America* 14:409, 1946.
21. Hilding, A. C.: Studies on the Otic Labyrinth: 6. Anatomic Explanation for the Hearing Dip at 4096 Characteristic of Acoustic Trauma and Presbycusis, *Ann. Otol. Rhinol. and Laryngol.* 62:950, 1953.

THE DEPARTMENT OF OCCUPATIONAL HEALTH

GRADUATE SCHOOL OF PUBLIC HEALTH

UNIVERSITY OF PITTSBURGH

offers

PROGRAMS OF GRADUATE EDUCATION

The following programs vary in length and level of study. They are designed to qualify the student for a masters' degree, and for selected students, a doctors' degree.

Occupational Medicine. Physicians who have completed one year of hospital internship may apply for admission to a program which has been approved by the AMA's Council on Medical Education and Hospitals, as graduate preparation for the specialty of occupational medicine.

Radiation Health. Physicians, engineers, and college graduates who have majored in physical science may apply for admission to a program which gives comprehensive coverage of the fields of health physics and radiobiology, and emphasizes the occupational and public health aspects of nuclear technology.

Toxicology. Qualified candidates are admitted to a multi-disciplinary program of study designed to give adequate preparation for a career of research in industrial toxicology.

Environmental and Work Physiology. A limited number of selected students are admitted to laboratory and field activities for evaluating the effects of impaired respiratory and cardiovascular function or fitness for different kinds of work, and the effects of superimposed thermal stress.

Industrial Hygiene. Qualified chemists, physicians and engineers are admitted to a program which presents in detail the technology of industrial hygiene, in the context of industrial and public health in which these activities are pursued. Doctoral candidates in this program carry on advanced studies and research in certain basic science fields of industrial hygiene: noise control, occupational health engineering, and analytical methods.

For further information and application forms write: Secretary, Graduate School of Public Health, University of Pittsburgh, 130 DeSoto Street, Pittsburgh 13.

Occupational Skin Problems

III. CASE STUDY AND DIAGNOSTIC APPRAISAL

Raymond R. Suskind, M.D., Cincinnati

This is the third of a series of 12 chapters treating various aspects of occupational dermatoses. The next installment will appear in the May, 1959, issue.

WHEN DERMATOLOGIC problems—singly or in groups—arise in industry, the effectiveness of the diagnostic evaluation depends, to a large degree, upon the proper orientation, knowledge, experience, and skill of the examining physician or consultant. The methods employed in the diagnosis of a suspected occupational disease do not differ essentially, in objective, from those utilized in a careful diagnostic evaluation of the nonindustrial medical problem. The sound principles of diagnosis are identical for the two kinds of problems.

1. General Objectives

The diagnostic appraisal of a dermatological case of suspected occupational origin is a piece of medical detection the purpose of which is to determine (1) the nature and cause of the skin disease and (2) how to prevent or control it. The physician who is called upon to manage a clinical problem in which occupational etiology is suspected should have several clearly defined objectives. They are:

A. To determine the nature of the cutaneous reaction.
B. To determine the offending agent, if possible, and accessory factors upon which the onset or progression of cutaneous reaction depends.
C. To determine if the cutaneous problem is of occupational origin.
D. To administer effective therapy.
E. To control exposure of the patient to the offending agent(s) in occupational or nonoccupational environments.
F. To return the patient to productive work with a minimum of time lost.

In this discussion, we shall be concerned primarily with the first three objectives.

It is necessary to determine whether or not occupational factors play a role in causation because the manner in which the case is managed therapeutically and from a preventive standpoint depends upon such knowledge. Furthermore, if the case is demonstrated to be of occupational origin, the problem is compensable and medical fees become the responsibility of the insurance carrier or a state agency. The hygienic measures which the physician will recommend will also be based upon the observations made in a thorough and skillful diagnostic appraisal.

The industrial physician, who is close to the operations in a plant, has the advantage over the consultant in that he understands the nature of specific operations in his plant; he is familiar with the work conditions of the affected employe; and frequently he or the plant hygienist has information about the toxic or hazardous properties of industrial materials—all of which knowledge is essential for the effective approach to an occupational skin disease.

When the problems are referred to a dermatologist, the effectiveness of his diagnostic evaluation depends not only upon his skill but upon cooperation of the medical, industrial hygiene, and production personnel of the plant, who must provide him with pertinent clinical information about the affected employe(s) and help him obtain all of the facts concerning the work exposure, without which an etiologic evaluation is very difficult. At the risk of offending some readers I might also state at this point that it is, as a general rule, impossible to evaluate dermatological problems of suspected occupational origin by just asking a few questions and making a superficial examination. These are problems which are not amenable to cursory methods whether used by the plant physician or the dermatologist!

Dr. Suskind is associated with The Kettering Laboratory in the Department of Preventive Medicine and Industrial Health, and the Department of Dermatology, University of Cincinnati, College of Medicine.

2. The Worker and His Skin Disease

As in other medical and surgical diseases, a skillfully acquired history often provides the physician with the most important clues. The history should be detailed and concern itself with the clinical manifestations, the medical background, the job, and other pertinent exposures which may be responsible for the skin reaction.

A. History of the Eruption—The itemized story of the skin manifestations should include information such as the following:

—date and manner of onset
—morphology
—regional distribution
—extension from the original site
—recurrence or periodicity
—previous therapy, if any, and patient's response to this treatment
—other employes affected.

In other words, when and where did the eruption start? How did it look? Were there papules, vesicles, pustules, nodules present? Did they itch or burn? Did it spread from the original site? Were exposed or nonexposed parts affected? How long was the patient on the job before the eruption started? Was the dermatitis present when the worker began his present job? These are the morphologic and temporal considerations.

If the problem is to be considered occupational in origin, it should be demonstrated that the cutaneous disease was not present before the worker entered the job in question. Temporal factors may vary considerably. When allergic occupational reactions are being considered, there is need to demonstrate a latent or incubation period, which may vary from five days to several months, from the beginning of a job to the onset of the eruption. In some instances reactions to primary irritants may be immediate, as with corrosive chemicals; in others the reaction may become apparent only after prolonged exposure; and in exposures to cutaneous carcinogenic stimuli, such as ionizing radiation or polycyclic hydrocarbons, many years may elapse before the keratoses or epitheliomata are seen.

The morphologic and regional aspects are of some significance but too often overrated. Where primary irritants and allergic sensitizers are involved, the areas most likely to be affected at the onset are the unclothed areas. There are some exceptions, especially in oily or dusty exposures, where the sites covered by saturated clothing may be more severely affected. This will be discussed further in the section devoted to the examination of the patient.

In problems of irritation, sensitization, folliculitis, if the eruption improves when the worker is away from the job as on vacation, or in shift of duties, and then recurs when the worker returns to the job in question, this is further clinical evidence that the cutaneous problem is precipitated by some factor inherent in the job to which the worker has returned. This part of the patient's history, and the dermatological findings, frequently provide the most important clues as to whether or not the occupational or nonoccupational factors may be considered as possible incitants.

The question as to whether or not the clinical problem may have had its onset on the present job, or another, arises. For example, the maintenance man of cooling and refrigeration equipment may have developed a skin reaction to the bichromate used in the circulating water but further questioning may provide the information that, while employed in a chrome-plating plant five years before, he had a similar eruption on his hands. Hence the worker either may have developed dermatitis on a similar job with another company, where the offending agent was the same or may have developed it when he was employed in a different industrial process in which the hazardous material was the same. If other workers doing the same work or handling the same chemicals are similarly affected, the possibility of the dermatitis being occupational in origin is increased.

B. Systemic Symptoms—The history of the present illness, while primarily concerned with the skin complaint should seek to ascertain possible involvement of other organ systems and they should be reviewed. In Chapter I the possible clinical consequences of the percutaneous absorption of toxic materials were discussed. Some toxic materials which provoke inflammatory reactions in the skin will also, if absorbed in sufficient amount, affect other organ systems, e.g., mercury compounds, beryllium, chlorinated hydrocarbon solvents. The acnegens, such as chlorinated naphthalenes and diphenyls, are potent hepatotoxic agents.

C. Previous or Concomitant Cutaneous and Systemic Disease—It is of some importance to know if the eruption in question is causally related, or the result of, or affected by some previously existing or concomitant skin or noncutaneous problem. Here are some notable examples: A worker who develops a pruritic erythematous eruption of the face and neck resulting presumably from exposure to an irritant may be found to have an underlying chronic seborrheic dermatitis or a history of atopic eczema. Both of these common skin conditions would probably render him more vulnerable to the irritant exposure. Another is the worker who develops a pruritic vesicular eruption on the

sides of the fingers which he attributes to the "new cutting fluid." A careful history and complete examination reveals a chronic tinea pedis and his "cutting fluid dermatitis" turns out to be an "id" reaction from the long-standing "athlete's foot." The latter confusion is a very common one.

In cases presumed to be contact eruptions of occupational origin, it is well to question the patients about a history of seborrheic dermatitis, dyshidrosis, dermatophytosis with recurrent "ids," infantile eczema, atopy, previously existing contact eruptions, housewives' dermatitis, pyodermas, and dry skin (or xeroderma). Some of these either may play a contributory role in the worker's reaction to an occupational irritant or sensitizer or may have to be considered in the differential diagnosis.

When the cutaneous problem is an isolated case of folliculitis or acne, it is important to know whether either of these problems was present during adolescence or prior to the patient's present work.

When keratoses and/or epitheliomata are attributed to chemical exposures in the job, it is well to consider also the type of skin of the patient, his reactivity to sunlight, the amount of outdoor activity during a lifetime, and whether he has been a farmer, seaman, open-cockpit pilot, or sportsman.

In this diagnostic evaluation psychogenic factors are not to be underestimated. The tensions and stresses of social relationships, at home and in the plant, are not infrequently found to coincide with the development of or exacerbations of eczematous dermatitis, urticaria, or pruritus alone.

3. The Worker and His Environment

Tracking down the etiologic factors requires not only a thorough look into the man's job but all of his other daily activities which may expose his skin to potential hazards. This again is made possible by a detailed history of these activities. Familiarity and experience with a wide variety of cutaneous irritants, sensitizers and other cutaneous hazards which are commonly noted in industrial operations, in the household, in personal contactants and hobbies, enables the physician to probe systematically for the offending agent and to focus his attention and subsequent efforts on a particular occupational or nonoccupational exposure.

A. The Job—In considering what aspects of a man's job may be responsible for his skin disease, it is necessary to think about the opportunities for cutaneous damage as afforded by:

1. The hazardous nature of industrial processes, physical factors and chemical materials.
2. The careless working habits of personnel.
3. Inadequate guidance of personnel in industrial operations and hygienic methods.
4. Inadequate protective regimen.

Frequently the physician is presented with a story that the skin problems appeared following the introduction of a new material into a process or that, whenever a particular substance is employed or handled, one or more workers are affected. Such a clue must be carefully examined.

Job information should include pertinent data about exposures prior to, at the time of, and subsequent to the onset of the eruption, such as the following:

(1) Types and concentration of chemical contactants.
(2) Manner and duration of exposure.
(3) Ambient conditions of work: temperature, radiation, humidity, dust, fumes, vapors, etc.
(4) Safety engineering control of hazards, if any, local ventilation, splash guards, etc.
(5) Protective measures: clothing, gloves, barrier creams, etc. How adequate are these? Are they innocuous?
(6) Cleansing facilities, including types of detergents.
(7) General housekeeping of the plant.
(8) Temporal relationship between exposure to one or several substances and development of cutaneous symptoms. Was something new introduced into the operation or job?

The examining physician will, of necessity, have to appraise the validity of an apparent temporal relationship between exposures to one or more substances and the subsequent development of symptoms. On occasion we have observed cutaneous reactions related not to the industrial work itself but to the cleansing agents and even to the "protective creams" supplied by the plant. In other instances we have observed employes handling known irritants who were provided with more than adequate measures of control but in whom, because of sloppy working habits or inadequate supervision, reactions occurred. The above listed information is, more often than not, available to the plant physician. When the patient is referred to the dermatologist, this same information should be sent to him at the time, or prior to the initial consultation. The dermatologist who is attempting to evaluate the case etiologically cannot possibly come up with the correct answers unless he is provided with clinical information as outlined under 2*A*, and data about patient's work environment, work habits, and previous medical record.

B. Nonoccupational Exposures—Probing into the patient's contactant exposures must include all possible nonoccupational activities as well as job factors. The list of substances with which there is periodic cutaneous contact in the worker's home, garden, garage, hobby room, is almost indeterminable. Some of the activities and their contactants are as follows:

GENERAL HOUSEHOLD

Kitchen and laundry: frequent immersions in water, soaps, detergents, food products.

General use: waxes, polishes, insecticides, disinfectants, herbicides, paints, lacquers, thinners.

PERSONAL HYGIENE MEASURES

Soaps, dentifrices, shaving creams, aftershave lotions, antiperspirants, shampoos.

COSMETICS

Hand lotions, creams, perfumes, colognes, powder, rouge, lipstick, hair-waving lotions and dyes, nail polish.

HOBBIES

Garden, shopwork, fishing, automative, athletics.

OTHER CAUSAL OR CONTRIBUTORY FACTORS

Topical medications, clothing, furnishings, foods, emotional factors.

We were required to evaluate the case of a young man whose dermatitis had been regarded for one year as related to aircraft fuels with which he had worked. Transfer to another job and therapy were ineffective and the dermatitis persisted. When thoroughly studied by patch test survey and usage exposures, he was found to have a multiple allergic hypersensitivity to a "hair oil" which he used as part of a commercial treatment-for-baldness course, as well as to nickel metal to which he was frequently exposed in the hobby of watch repairing. Avoiding these nonoccupational contactants proved to be the answer to this man's problem.

4. Examination Of the Patient

When a thorough diagnostic appraisal is to be done, the entire skin, its appendages, and accessible mucous membranes should be examined. It would seem almost unreasonable to suggest that even when the area of chief complaint involves the hands a complete cutaneous survey be carried out. However, restricting the examination to the hands alone might lead one to neglect the significant tinea pedis or onychomycosis and mistakenly regard the problem as an occupational contact eruption instead of an allergic mycid. In another instance avoidance of a complete examination might cause the examiner to miss the diagnosis of lichen planus, especially if the mucous membranes, trunk and genitalia, where lichen planus lesions commonly occur, were disregarded.

In many instances, too, the patient may be unaware of lesions on parts of the body which he is not likely to view frequently.

A. Regional Distribution— Occupational dermatoses most frequently develop on exposed areas such as the hands and forearms when the offending agent is a liquid or solid; on the face if the agent vaporizes or is in dust form or when there is splashing or contact with contaminated hands. When the agent is in vapor, fume, or dust form, it may penetrate the clothing and nonexposed sites may be affected. The dermatitis occurs not infrequently on portions of the body over which the wearing apparel fits snugly or at points of friction—the belt line, collar edges, cuff or sleeve edges, and ankles at shoe tops. The offending substance is likely to concentrate in these areas, and, because of friction and rubbing, cutaneous penetration is enhanced.

The eruption may start in an exposed site and eventually become generalized. This occurs particularly with agents which are sensitizers, such as the nitrated and chlorinated benzene compounds, intermediate dyes, turpentine, chromate, and nickel. Generalized eruptions may be seen following exposure to potent acnegenic compounds, such as chlorinated naphthalenes and diphenyls; agerite alba may cause widespread depigmentation.

B. Morphology—The types of lesions will vary to some degree with the components of the skin which react to a particular inciting agent. Pathologic patterns and reaction sites were discussed in some detail in Chapter I. The gross lesions and symptomatology also vary in morphology and in severity.

Primary irritants or allergic sensitizers may provoke a very mild reaction which is characterized by pruritus alone or mild erythema with or without itching. More severe reactions are characterized grossly by papules, vesicles, swelling, erythema, oozing, and even ulceration. In chronic contact dermatitis, lichenification may be more prominent than the erythema, swelling, and vesication.

Bacterial and mycotic infections provoke reactions which will vary to some degree with the type of organism. Staphylococcic infections are commonly pustular. Dermatophytes affecting the glabrous skin may provoke the circinate type of lesion (ringworm); when the plantar or interdigital areas are infected, vesiculation is common.

Other reaction types may be follicular, acneform, or miliaria-like, or may be characterized

by depigmentation, hyperpigmentation, hair loss, epidermal fissures, callosities, atrophic skin, keratoses, and epitheliomata.

In some dermatological centers it is held that one can generally differentiate occupational reactions of allergic origin from other dermatoses of the hands on the basis of morphology and location, and that the occupational allergic reactions are characterized by a diffuse erythematous, sometimes vesicular, pruritic eruption on the dorsa of the hands and fingers. This rather limited view may cause one to miss many allergic reactions which in fact may take many forms, e.g., scattered erythematous papules, grouped papules, vesiculopapules, vesicles, well-demarcated nummular patches, and keratotic patches. These reactions may affect the palmar aspect as well as the dorsum of the hands.

5. Differential Diagnosis

With the clues provided by the detailed history and thorough physical examination it is frequently possible to develop a clinical opinion regarding the problem at hand. For example, one may differentiate an eczematous contact dermatitis from seborrheic dermatitis, or from a mycid resulting from a tinea pedis infection or dyshidrosis. It is well to bear in mind, however, that not infrequently one cannot separate the etiologic factors clearly and a contact dermatitis may complicate a mycotic id reaction of the hands, or be complicated by a dyshidrosis of the hands. It is also possible frequently to differentiate a contact dermatitis from infectious eczematoid dermatitis, although the latter may complicate an occupational contact problem. By history and diagnostic patch tests one may differentiate an eczematous contact dermatitis of occupational origin from nonoccupational origin. The other problems which are probably more easily differentiated on morphological and regional as well as historical considerations are circumscribed neurodermatitis, atopic dermatitis, lichen planus, psoriasis, pityriasis rosea, pyodermas, erythema multiforme, and seborrheic dermatitis.

The follicular and acneform problems, pigmentary disturbances, and miliaria of occupational origin can be differentiated from those of nonoccupational origin by history of exposure to materials or physical conditions which provoke such reactions, as well as, in some instances, on the basis of the regions in which such lesions occur predominantly in an industrial exposure. The problem of differentiating between neoplastic changes on the exposed sites as provoked by a lifetime exposure to sunlight and those changes provoked by excessive ionizing radiation or chemical carcinogens is a troublesome one. The differentiation may be made on the basis of multiple clues, including type of skin, reactivity to sunlight, areas involved, and history of prolonged exposure to a carcinogenic agent. An etiologic opinion can be given with a fair degree of certainty in most cases of cancer of the scrotum which rarely occurs "spontaneously" and may be linked with exposures to chemical carcinogens.

During the clinical examination evidence of systemic toxicity should also be ascertained.

6. Diagnostic Tests

Most of the laboratory and clinical diagnostic methods used in general dermatology are helpful in the evaluation of a suspected occupational problem. These include cutaneous biopsy, bacterial and mycological examination and culture, Wood's light examination of suspected mycotic lesions, dark field examination, cutaneous tests for reactivity to specific microorganisms (e.g., Frei, histoplasmin), and intradermal or scratch tests to suspected inhalants. Since allergic hypersensitivity of the delayed type is a common occupational disease, one of the most helpful procedures is the diagnostic patch test.

A. The Diagnostic Patch Test—The diagnostic patch test, when carried out properly and interpreted correctly is of great value, (1) as an aid in detecting the cause of allergic contact dermatitis and (2) as an aid in differentiating between allergic contact dermatitis of occupational and that of nonoccupational origin.

The technic of testing is relatively simple, but there are probably more errors made in performance and interpretation of this test than any other employed in the field of dermatology. The reader is referred to two excellent reviews of this subject in which the entire gamut of technical considerations are discussed. Those physicians who are doing patch tests are urged to become familiar with their content.[1, 2] It is also necessary to become familiar with tables of recommended test concentrations which may be employed.[3]

1. TECHNIC AND TYPES. The patch test consists essentially of the application of a suspected material to the normal skin of the patient who has clinical manifestations of an eczematous contact dermatitis. It is an attempt to challenge the patient with a nonirritating concentration of a suspected material to determine whether or not after a suitable lapse of time (24 to 48 hours) an eczematous allergic reaction may be elicited. Irritating concentrations of chemical materials must be avoided.

There are two general types of tests: (1) closed and (2) open. The most useful type and the one most commonly used is the closed or

covered type. The test material—liquid or solid—is placed on an absorbent pad composed of four-ply gauze, flannel, or filter paper, which should not be smaller than 2 × 2 cm. This is covered with a slightly larger square of inert plastic, such as cellulose acetate, and retained in place with a square of adhesive tape 4 × 4 cm. The plastic material (1) may afford greater absorption of the test substance, (2) demarcates the area of application, and (3) enables one to differentiate the reaction to the test substance from an adhesive tape reaction.

The application is allowed to remain on the skin for 24 hours when substances which are recognized as potent sensitizers are used, and for 48 hours or longer when the sensitization capacity is known to be moderate or low or is not known at all. Following removal, at least 15 to 20 minutes should be allowed to elapse in order for the skin to recover from the pressure of the application, before a reading is made.

2. INTERPRETATION. Reactions are usually graded according to their intensity:

1+ mild to moderate erythema
2+ intense erythema or erythema with papules and/or minimal vesiculation
3+ erythema, swelling and vesiculation, or definite vesiculation alone
4+ bullous or ulcerating reaction.

The numerous factors which influence the results of the patch test should be appreciated. They include the level of hypersensitivity or reactivity of the patient's skin; the concentration of the applied sensitizer, duration of application, total area, and the skin site tested. Other factors which are not easy to control are environmental and include temperature, humidity, sweating, local friction, pressure, and ventilation of test site beneath the patch.

A list of practical hints for patch testing may be useful:

The diagnostic patch test should be used only when the case in question is an eczematous contact-type of problem in which there are one or more contactants held in suspect. Clinical indications must be determined by historical data and physical findings. If one is attempting to differentiate between occupational and nonoccupational causes, suspected materials from both types of exposures should be applied.

A positive reaction, then, is used as supportive evidence where there are clinical indications that the patient has been exposed to a given material.

B. Immersion and Usage Tests—For clinical cases involving the hands in which patch tests have not been revealing, or in which the suspected exposures include repeated and frequent exposures to mild irritants, such as aqueous cleansing solutions or organic solvents, immersion tests may provide additional diagnostic information. The tests are usually performed following the complete subsidence of the eruption, and involve repeated immersion of the hands in usage concentrations of the suspected solutions for periods up to 10 minutes and for as often as six times daily.

Usage tests either may be used to corroborate the results of patch tests or may provide additional positive information regarding the relationship between the clinical problem and a suspected exposure. They may be employed following regression of the skin lesions after a period of avoidance and simply involve limited reexposure of the patient, under observation, to the suspected materials or industrial process.

A flare of the skin lesions following reexposure is much more significant than the result of the patch test. In some instances in which completely negative patch tests may be observed, an exacerbation of lesions will occur during the reexposure or usage test.

The Do's and Don'ts of the Diagnostic Patch Test

Do's	Don'ts
1. Employ nonirritating concentrations of test substances.	1. Don't test with irritating concentrations.
2. Use patches at least 2 × 2 cm., and larger sizes for fabrics.	2. Don't employ substances about which you have insufficient information.
3. Employ control substances of similar nature and/or control subjects.	3. Don't patch test with known sensitizer unless suspected from history.
4. Apply for sufficient length of time: 24 hours for potent sensitizers; 48 hours, or longer, for others.	4. Don't be stingy with test areas. Size of test area is significant.
5. Allow skin to recover for at least 15-20 minutes before reading.	5. Don't test during acute phase of dermatitis.
6. Observe for delayed reactions from 72 hours to several days after removal of patches.	6. Don't use the results of patch test as the sole evidence of causation.
7. If possible, reexpose patient to incriminated substance under usage conditions.	7. Don't use old test solutions of washing products, bleaches, etc. Use fresh solutions.
8. Use your results to corroborate clinical evidence.	

Summary

In the systematic appraisal of a cutaneous problem in which occupational factors are suspected, significant medical clues are provided by the following:

(1) a thoroughgoing and detailed history of the patient's skin disease, work environment, and nonoccupational environment;

(2) a careful physical examination of the skin and other organ systems; and

(3) the use of several types of diagnostic tests, the most helpful of which is the diagnostic patch test.

The physician's decision as to what is (are) responsible for the eruption is based upon the consideration and integration of all of the pertinent information developed during the case study.

Dr. Suskind's address is The Kettering Laboratory, University of Cincinnati, Cincinnati 19.

References

1. Role of the Patch Test in Contact Dermatitis: Report of the Committee on Occupational Dermatoses of the Council on Industrial Health, *J.A.M.A.* 156:497-499, 1954.

2. Rostenberg, A. Jr.: The Patch Test, *GP* 10:104-111 (Nov.), 1954.

3. Schwartz, L.: Tulipan, L., and Birmingham, D. J. Occupational Diseases of the Skin, Ed. 3, Philadelphia, Lea & Febiger, 1957, Chap. 5, Pp. 70-85. (This list was compiled by *Drs. A. Rostenberg, Jr.* and *M. B. Sulzberger* and originally published in *J. Invest. Dermat.* 2:93, 1939.)

PERMANENT COMMITTEE AND INTERNATIONAL ASSOCIATION ON OCCUPATIONAL HEALTH

announces

13TH INTERNATIONAL CONGRESS ON OCCUPATIONAL HEALTH

July 25 to 29, 1960

Hotel Waldorf-Astoria, New York City

Physicians, nurses, industrial hygienists and representatives from more than 40 countries will attend the 13th International Congress on Occupational Health. Prevention is the major theme of this Congress.

New and old problems will be discussed. Valuable knowledge will be shared in the following aspects of occupational health; administrative methods, medical and surgical practices, education and training, social and legal aspects, work physiology and psychology, environmental factors in health, environmental hygiene and hazards of specific industries.

Plan now to attend. Occupational health knows no geographic boundaries. For information write to Dr. Robert E. Eckardt, Secretary-General, P. O. Box 45, Linden, New Jersey, U.S.A.

Individuals who wish to present papers at this Congress on any of the subjects listed above should obtain detailed information by writing promptly to Dr. Irving R. Tabershaw, Chairman of the Scientific Program Committee, International Congress on Occupational Health, 375 Park Avenue, New York City, U.S.A.

Editorial

Ergonomics

The Greeks had two words for it. Our resourceful English friends made one do, and gave us "ergonomics." In our country the science of work as applied to man had a substantial development during World War II and has become known here as human factors engineering.

In the rapid development of the machines of war, it became apparent that the limitations of the man-machine complex reside in man. Anatomists, physiologists, and psychologists set out at once to define these limitations in terms that were meaningful to engineers, who were then able to design the machine as an extension of man. The design of a military tank might be used to illustrate this reversal of view. In the established tradition this exercise begins with the cannon, moves on to the vehicle which carries the cannon, and ultimately provides some accommodation for the soldier who must operate the total weapon. It is known that the determinant of effectiveness of this system is not the excellence of the cannon but the ability of the soldier inside the tank to perform under the conditions of high environmental heat and noise levels, dense fume, limited visibility, and cramped quarters that are his lot. Under the influence of ergonomics, the designers of this system would be expected to give first consideration to the performance and endurance limitations of the soldier, build the tank around him in such a way as to let him make the most of his capacities, and finally hang the cannon on any place that does not result in a conflict with the purposes of the first two components.

The problems of the military tank find their civilian counterparts in the production complexes of industry. Such factors as work arrangements, spatial dimensions, seats, levers, control panels, information transmission and storage, sustained attention, and microclimatology, under the influence of the ergonomists are becoming fundamental considerations in the development of industrial automation.

Growing interest in this whole field was highlighted by a conference in Zurich in February, 1959. Sponsored by European Productivity Agency of the Organization for European Economic Co-operation, the conference developed the theme of Fitting the Job to the Worker. The program speakers were drawn from Western Europe with representatives of European industrial management and labor organizations making up the audience. At the conclusion these groups adopted a resolution calling for appropriate application in European industry of the ergonomics concepts presented at the conference.

We look upon this as a straw in the wind to be taken seriously. Preplacement examinations, now based on the discovery of disease processes and disabilities, may be expected one day to include the measurements required for exact matching of human capacities with machines designed by engineers trained in the application of the principles of ergonomics. It is to be hoped that industrial physicians will become sufficiently well acquainted with this development to be in a position to make contributions from broad clinical experience to an endeavor now carried on predominately by representatives of the basic health sciences.

THE PRESIDENT'S MESSAGE

H. W. LAWRENCE, M.D.

THE END of a presidential term is an excellent time to evaluate the progress of our Association. Most of you are aware of the work that goes on throughout the year; however, this may refresh your memory and, above all, impress you with the importance of the work of the members.

Committee Activity—Our regular standing committees now number 29, and are active in carrying on the many pertinent phases of the Association's work. There seems to be a definite trend toward participating in many related but outside activities with other organizations; hence the so-called "joint committees" are coming into the picture more and more.

IMA Membership—Through the diligence and efforts of our Membership Drive Committee, under Dr. Robertson's leadership, we acquired more new members than in any previous year. At this writing, we are well above the 500 figure for the year and by the end of April will have penetrated the 4,000 total membership level. Of our total membership, about 40% are full-time plant physicians or medical directors and the remaining 60% are part-time physicians or medical directors in industry.

IMA History—This History has long been in the process of preparation and is now about ready for the printer, as soon as necessary funds can be found to meet the costs of publication. Dr. Whittaker's History Committee has made a noteworthy contribution to IMA, as well as to medical history generally.

District Counselors—Under the patient but persistent guidance of Drs. Lamb and Rowntree, the various districts were committed early in the year to activities ranging from recruitment of new members to organizing new components.

Component Societies—We welcome a new component to the fold—the Minnesota Academy of Occupational Medicine and Surgery. Two additional component societies are presently in the making—the Rocky Mountain States and the Western Ohio. The trend is in the right direction. It is to be hoped that in the near future most IMA members will hold membership through a component society.

Occupational Health Institute—You have had occasion to hear very little about the OHI during the year. Nevertheless, there have been many meetings and considerable activity in its connection. Moves are now pending which will place this activity prominently in the picture, where it rightfully belongs. Joint accreditation of industrial facilities on the part of IMA, AMA, and other interested organizations is a most logical and progressive step in the right direction.

New Journal—The most significant event of our year in office was the publication of the JOURNAL OF OCCUPATIONAL MEDICINE. This publication is owned by your Association "lock, stock, and barrel." It was an immediate success. The circulation at this writing is 4,633, which includes 3,963 active members of IMA and 670 non-member, direct-paid subscribers. Both the membership of IMA and the number of direct paid subscribers are increasing daily.

Headquarters Staff—Last but by no means least, we commend our good people at 28 East Jackson Boulevard for the many overtime hours, for commuting with heavily laden briefcases, and for responding with loyalty and enthusiasm to the demands we made on them. There were just not enough hands to go around and to do all the things that needed doing. In addition to their established duties, they had a new journal to publish. This task alone ordinarily requires a staff the size of our present headquarters group. Our sincere appreciation and thanks is extended in acknowledgment of their fine effort.

Book Reviews

INDUSTRIAL HYGIENE AND TOXICOLOGY, Second Revised Edition. Vol. 1—General Principles. Edited by Frank A. Patty. Price, $17.50. Pp. 807. Interscience Publishers, 250 Fifth Ave., New York, 1958.

Major changes in emphasis in this second edition of what has become one of the standard works in the field of industrial hygiene are found in the subjects of noise, heat, ionizing radiation, human engineering and industrial safety, sanitation, air pollution, and illumination. While this expansion leads in some cases to duplication of subject matter, it makes the book more valuable as a reference work.

In the introductory chapter, entitled "Industrial Hygiene—Retrospect and Prospect," the editor provides an orientation in the form of an historical résumé of industrial hygiene literature, labor legislation, and significant events in the progress of industrial hygiene in the United States. He has included a list of the more important and better known books in the field of industrial hygiene and toxicology and traced the development of the specialty in this country and in Europe.

The chapter on "Industrial Hygiene Records and Reports," by Ruth B. Patty, emphasizes that no one set of forms and records can be adapted to every industrial hygiene organization and lists typical forms which may be used for records of the environment, medical examination records, nurses records, records of biological specimens, safety records, personnel records, and compensation claim records. The collection of data and the statistical analysis theeof are discussed in some detail. Important points in this chapter are (1) that there is no field of endeavor in which good statistical data are of more value than in industrial hygiene and (2) that always in back of the data stand the persons who collected them and the one who analyzed them for the conclusions to be drawn.

Industrial hygiene surveys are personal investigations conducted within the premises of an industrial establishment, primarily to determine the nature and extent of any conditions that may adversely affect the well-being of the persons employed. The explanation of the various types of such surveys is the subject matter of a chapter detailing (1) the standardized inspection, which deals only with potentialities; (2) the preliminary or observational survey, which is a reconnaissance; (3) the investigational or appraisement survey, which as its chief purpose the evaluation or control of existing harmful situations; and (4) the combined industrial hygiene and medical survey, which integrates the investigational survey with medical examinations of the workmen. General qualifications and training of personnel, including the administrative industrial hygienist, industrial hygienist, and other persons who may be found in well-staffed units, are also outlined in this chapter and the overlapping of interests and disciplines in the field is emphasized.

It has often been stated that the majority of industrial accidents can be attributed to human error. This is true not only in the various fields of transportation but also in most other industries that have not been completely mechanized. Many believe, therefore, that the greatest promise in the control of accidents lies in the elimination of the human element by complete mechanization. In the chapter on "Human Engineering and Industrial Safety," Dr. Ross A. McFarland points out that, although complete mechanization has been accomplished in some fields, the fact remains that a large percentage of the persons who are gainfully employed operate, or are exposed to, some type of equipment or machinery. The thesis is developed that, in addition to the established methods of combating industrial accidents, there is a relatively new discipline, commonly called human engineering, which relates the mechanical design of the equipment to the biological and psychological characteristics of the operator. By and large, the employee today must still adapt himself to the tools and equipment provided him and to the methods of work prescribed for everyone. This chapter points out that the gains that result from adapting equipment and working methods to the individual are of demonstrated significance. This does not mean, as is sometimes believed, that equipment and methods need to be developed for each individual but, rather, that optimum conditions can be discovered for groups of workers.

Extensive consideration is given to the design of displays and controls. Displays impart to the various sense organs information regarding the functioning of the machine or equipment. Factors affecting visibility are discussed in relation to the size of critical detail, contrast, illumination, time of exposure, and color. Experimental findings are reported in regard to optimum shape, size, and design of dials and indicators. Auditory, tactual, and kinesthetic displays are also discussed. In the design of controls, special consideration is given to range, strength, speed, and accuracy of body movements in relation to location, shape, size, direction of movement, and gear ratio of the controls. The physical variables of the environment are then considered briefly as they relate specifically to the design of the working area.

Within the purview of industrial sanitation are the principles involved in controlling the spread of infection or other insults to the health of the employee that are not inherent in the manufacturing processes per se. This chapter, by M. A. Shapiro, considers the areas of (1) provision of a safe, potable and adequate water supply; (2) collection and disposal of liquid and solid wastes; (3) assurance of a safe food supply; (4) control and elimination of insects and rodents, especially

those known to be vectors of disease; (5) provision of adequate sanitary facilities and other personal services; and (6) maintenance of general cleanliness of the industrial establishment.

Details of utilization and conservation of water in industry are adequately discussed, as are problems arising in the handling of food and the use of food-vending machines. The qualifications of the sanitarian in industry, his functions and value are outlined in this chapter which also contains a good list of general references on the subject.

In a chapter on the "Mode of Entry and Action of Toxic Materials," Patty has classified these materials according to physical properties and physiological action. The chemical classification will be found in Volume II. Aware of the need for fundamental understanding of the physiology involved in the absorption of toxic substances, the author has devoted a number of pages to the mechanics of respiration, the physiology of hemoglobin, and circulation. He also provides information on volume-pressure-temperature relations and the physics of partial pressures and solubility important in the uptake of gases, vapors, dusts, and fumes. This chapter contains threshold limit values adopted by the American Conference of Government Industrial Hygienists in 1957.

Problems involved in sampling and analyzing air contaminants are discussed from a general viewpoint rather than detailed methods of analysis. Nevertheless, the chapter on "Sampling and Analysis of Atmospheric Contaminants" presents a great deal of valuable information regarding such methods as the interferometer, combustion devices, ultraviolet absorption, and methods requiring laboratory analyses of gases and vapors. With respect to dust, fumes, and smokes, all of the methods based on impingement are discussed, as well as those based on electrostatic precipitation, thermal precipitation, filtration, and sedimentation. Very detailed information is given for making and computing dust counts and for determining particle size distribution. Methods of determining quartz by chemical, petrographic, and x ray diffraction are succinctly explained.

A chapter on "Air Conditioning," by Kenneth E. Robinson, is brief but very informative. It outlines the effects of temperature and humidity on man and his well-being, and the mechanics of providing an environment in which these factors are suitable.

The chapter on "Air Cleaning" is quite complete and is profusely illustrated to show the various mechanical devices. It deals with the principles of air cleaning and the problems of selecting effective quipment for controlling quality of air in the industrial environment. Consideration is given to both air-conditioning applications and air-pollution control applications, and an excellent classification of cleaning processes is provided. Information is included on the various types of separation filters and precipitators as well as washers and scrubbers. Helpful data on the selection of the right air-cleaning system for specific requirements and a rather complete bibliography complete the chapter, which was contributed by W. N. Witheridge.

The same author wrote the chapter on "Ventilation," which he defines as the process of passing clean air through any space, room, or building, with the object of diluting air-borne impurities to a safe or acceptable concentration or adjusting the heat and humidity in the environment. Contrary to popular belief, the control of oxygen and carbon dioxide for human respiration is not the major concern of ventilation.

The various types of respirators and respiratory protective devices are allotted a brief chapter, contributed by the editor and explaining the different types of air-purifying respirators as well as those which supply the atmosphere. The color code for cannisters is tabulated, and there is an excellent outline showing suitable respiratory equipment for typical situations. Helpful instructions are given on selection, examination, and cleaning and sterilizing of respiratory devices.

One may wonder at the inclusion of a purely medical subject such as "Pulmonary Dust Diseases" in a book devoted to industrial hygiene and toxicology. This chapter by O. A. Sander might more logically be found in a medical text, but its value as a reference is no less and it adds considerably to the general interest of the book. It discusses the properties of dust, dust concentrations, and particle size, and gives an excellent classification of dusts based on their effect on the body. Since any such classification may lead to dangerous oversimplification, Sander has wisely included a brief explanation within the classification. The anatomy and physiology of the respiratory tract is discussed briefly, but the pathology and x-ray findings in silicosis are treated at some length. Asbestosis, Shavers' disease and diatomaceous earth pneumoconiosis are covered, as is coal workers' pneumoconiosis, the most recent of these diseases to receive attention. The new International Roentgenological Classification of the Pneumoconioses is illustrated.

Air pollution is one of the foremost problems in public health today. In this chapter, George D. Clayton first traces the history of air pollution from 361 B.C., when Theophrastus noted that "fossil substances called 'coals' burn for a long time, but the smell is troublesome and disagreeable." The first smoke abatement law was passed in England in 1273. With respect to the acute effect on health, the author provides great detail concerning the incidents in the Meuse Valley, Donora, Pa., London, and Paza Rica, but regarding the chronic effects he states that they are more elusive and lists a number of questions which need to be answered. The effects on vegetation and on structures are considered as part of the over-all economics of air pollution. Sources and kinds of air pollution and control procedures are outlined, as are meteorology and topography among practical considerations for plant management.

Occupational dermatoses, in a chapter written

by Louis Schwartz, are treated in outline form and classified according to predisposing and actual causes. The latter are subclassified as mechanical, physical, chemical, and biological, with the chemical being divided into primary irritants and sensitizers. Diagnoses of the occupational dermatoses, patch testing, and pre-employment examinations are subjects which seem rather clinical to be found in this book. The same can be said of the section on treatment. On the other hand, methods of investigation and prevention certainly have a place in the field of industrial hygiene. There is an excellent brief section on skin hazards according to types of workers or occupations.

A chapter on the "Visible Marks of Occupational Disease," by Carey P. McCord, is interesting but, again, one feels that this subject must have been included in a book of this type because of general interest. Most of this chapter is in tabulated form, listing the mark or sign (usually a clinical observation) and giving its probable cause.

"Fire and Explosion Hazards" are covered in a chapter divided into two sections. The first section, by G. W. Jones, deals with the hazards of combustible gases and vapors, and the second, by Irving Hartmann, considers combustible dusts. In these sections the limits of flammability, ignition temperatures, and flash points are given in numerous tables. The substitution of less hazardous materials and the proper methods of control, such as segregation and ventilation, are discussed. Similarly, the ignition temperatures of dusts and minimum explosive concentrations are tabulated. The prevention of dust explosions and fires is carefully outlined in a step-by-step fashion.

The "Physiological Effects of Abnormal Atmospheric Pressures" are considered in a chapter, by Heinz Specht, which covers the composition of the atmosphere and the physical attributes of atmospheric gases in considerable detail. This background serves to explain the sections which follow on the effects of increased and reduced atmospheric pressure on the body. The effects of sustained increased atmospheric pressure, including oxygen poisoning, are discussed, and it is pointed out that at the pressure existing in most caisson installations the incidence of disturbances during maintained pressure is very low. The mechanical effects of decompression, governed by such factors as rate of decompression, are discussed. Among the effects of maintained low atmospheric pressure are hypoxia and hypocapnia, both of which affect muscular control and mental processes.

The important and timely subject of "Industrial Noise and the Conservation of Hearing" is allotted a chapter written by Jerome R. Cox, Jr. It contains a clear exposé of the fundamentals of noise, including frequency, wave length, and measurement of sound pressure. The analyses of frequencies and intensity levels are explained. Transmission, radiation, and absorption phenomena are outlined and practical examples provided. There is a section on the ear which explains briefly the anatomical and physiological components and defines normal hearing. The use of the audiometer, its calibration, and the design of audiometric rooms are discussed. Characteristics of hearing loss resulting from noise are described, and the difficult question of how much noise exposure causes hearing disability is raised but not answered. The chapter contains an excellent section on noise control, giving attention to control at the source, control by enclosure, and control by ear protection.

"Radiant Energy" is a chapter contributed by Leon F. Curtiss and concerned with penetrating ionizing radiation, infrared radiation, corpuscular radiation, and poisoning by radioisotopes. Radiant energy produces undesirable effects in the human body whenever it is absorbed in excess of the amount to which the human organism has been accustomed in its natural surroundings. The injury to cells is proportional to the ionization produced in the cell. The effects on the human body as a whole, however, may vary considerably, depending on the types of radiation, the way it is applied, and the kind of cells destroyed or injured. The penetrating radiations, such as x-rays and gamma rays, are distinguished by their ability to produce effects throughout the whole body at one time. The long wave lengths of infrared radiation inflict no deep injuries on the body, since they are readily absorbed by the surface tissues. Although they have low penetrating power and can be stopped by a few inches of air, alpha particles represent a source of injury when the substance emitting them is inside the body. The beta rays, on the other hand, have considerable more penetrating power and require the protection of screening. The functions of the health physicist are discussed in this chapter, which also gives important information on protection from the various forms of radiant energy.

"Lighting for Seeing" is the heading of a chapter by Sylvester K. Guth and E. A. Linsday. The authors define lighting terms and units and discuss the factors which affect visibility. Various types of light sources, such as incandescent, fluorescent, and mercury lamps are described, and the chapter contains many illustrations of properly and improperly lighted work-areas. A long table is appended which gives current recommended illumination values for many processes and operations.

The final chapter, entitled "Heat Control in the Hot Industries," by T. F. Hatch, is concerned with the protection of workers in the so-called hot industries, where heat exposures are increased substantially above the normal levels fixed by the local climate because of the extra heat added to the environment by the hot processes. Exposures are classified as (1) hot dry, including steel mills, forge shops and glass plants, and (2) warm-moist, such as laundries, and mines with extensive use of water. The effects of heat on man are portrayed in a figure dividing thermal stress into the comfort zone and the zones of physiological and psychological disturbance. The author outlines the physiological limits of heat exposure and calcu-

lates the limits to maintain thermal balance. Examples are given to illustrate the application of physical analysis to the evaluation of typical heat exposures. Heat control by insulation, shielding, and ventilation is thoroughly explained and the supervision of employees in hot industries is discussed.

This book, representing the contributions of very well qualified persons, will be useful to engineers, physicians, and anyone else interested in the general field of industrial hygiene. It will rank high as a reference work, yet is sufficiently complete to provide thorough treatment of each of the subjects it contains. It can be expected that the forthcoming volumes will elaborate respectively on toxicology and environmental analysis for those who need more specialized assistance in those areas. For all ordinary situations, however, we look to a reference book for general information, and this volume should adequately meet all such requirements.

DANIEL C. BRAUN, M.D.

PNEUMOCONIOSIS IN DIATOMITE MINING AND PROCESSING. W. Clark Cooper, M.D., and Lewis J. Cralley, Ph.D., with the assistance of W. H. Clark, M.D.; B. R. Hubbard, M.S.; D. J. Hurley, M.D.; and R. R. Sullivan, M.D., prepared under direction of W. M. Gafafer, D.Sc., Technical Adviser. Public Health Service Publication No. 601. Price $0.55. United States Government Printing Office, Washington, D. C., 1958.

This 96-page booklet covers a review of the literature on diatomite pneumoconiosis, a description of the manufacturing process, results of initial environmental-medical studies, follow-up procedures, and recommendations for the control of pneumoconiosis in the industry.

The deposits of diatomite in California attracted attention as a potential industrial material toward the end of the last century, but World War II was largely responsible for the development of the industry to its present important status. According to the U. S. Bureau of Mines, more than 300,000 tons of diatomite were produced in 1953 with a value at the mine of more than $10,000,000. The five plants located in California, Nevada, and Oregon accounted for 95% of that year's production in the United States.

Diatomite is also known as diatomaceous earth, diatomaceous silica, kieselguhr, tripolite, and fossil flour, and is often confused with tripoli and fullers' earth. It has many uses today, some of which include the manufacture of filters, insulation, liquid absorbers, polishes, and fillers. Diatoms are microscopic unicellular plants, from 5 to 100μ in size, whose cell walls are composed of practically pure opaline silica. Fresh and salt water types occur, and the pulmonary disease which they can provoke depends to a great extent on whether exposure has resulted from the crude amorphous diatomite or the calcined material in which the noncrystalline silica has been converted to cristobalite.

The respective sections of the current book are well arranged and each chapter follows in logical sequence to present a clear, concise, and informative picture of the entire industrial process as well as the health problems associated with it. The list of medical consultants is impressive, and the cooperative effort of well-known authorities, industrialists, and union representatives who assisted in the project demonstrates an effective approach to the problem of combating pulmonary occupational disease.

The chapter on environmental studies is particularly well done and encompasses accepted methods used in counting and analyzing samples of air-borne dust. General recommendations for hygienic control of the hazard include capture of particles at the source, improvement in housekeeping, maintenance of equipment, and the use of respirators where feasible.

The authors stipulate that the medical studies were subject to certain limitations so that precise estimation of the incidence of symptoms, radiographic changes, and altered function associated with environmental factors, was not possible. X-ray examinations are extensive, but a simpler classification of findings might have been more effective if expressed in terms that could be easily followed by readers with less knowledge of the subject. The usual difficulty of obtaining unanimity of opinion on roentgenographic interpretations has been encountered in this study, as it has in other similar undertakings. Because of difficulty in reproduction, films manifesting nodular linear changes alone were not included. Accordingly, only four roentgenograms depicting coalescent changes are shown out of a series of 869 films made in the survey. These radiographs are exceptionally well reproduced, and it is unfortunate that a wider selection could not have been presented.

The investigators observed that, in general, symptoms and pulmonary ventilatory tests corresponded poorly with roentgenographic findings except in the case of massive confluent lesions. Among other findings it was concluded that workers with unusual susceptibility to diatomite dust may develop definite roentgenographic changes in their lungs in five years' time. On the other hand, the chest x-ray patterns of employees with many more years of service in this industry may be negative. Exposure to dust with high cristobalite content elicited severe responses in relatively short periods of exposure. In contrast, the response to the amorphous diatomite was much milder. Roentgenological changes consistent with a diagnosis of pneumoconiosis were found in 9% of the 869 diatomite workers examined, while doubtful alterations were noted in an additional 9%.

While this attractive, well-illustrated book will prove most valuable to those who live and work in the specific areas where the possibility of diatomite pneumoconiosis exists, it will also be of importance to everyone interested in lung conditions, whether these be the result of occupational exposure or not.

LLOYD E. HAMLIN, M.D.

Abstracts of Current Literature

Experimental Toxicology

Robert E. Eckardt, Ph.D., M.D.

A Method for Reporting Toxicological Information. C. E. Lewis.* A.M.A. Arch. Indust. Health 18:457 (Dec.) 1958. (*Institute of Industrial Health, University of Cincinnati.)

It is proposed that toxicity data should be reported in terms of milliequivalents or milimoles per kilogram rather than on the strictly weight basis of milligram per kilogram. When the LD's of 30 metal chlorides (subcutaneous injection in rats) were compared both as mg metal chloride per kg and as mEq metallis ion per kg, not only was there a change in the relative positions of the metallic ions when arranged in order of log LD's, but also a grouping of ions was apparent in the mEq/kg scale. The most toxic group—mercury, indium, thallium, arsenic and gold—was about five times more toxic than the next group—cadmium, vanadium, and barium—which was about three to four times more toxic than the next group of iron, cerium, copper, and manganese. This latter group was about 10 to 12 times more toxic than the large group of cations following it (sodium, calcium, nickel, magnesium, lithium, etc.). On the mg/kg scale, distribution was fairly regular.

Pharmacologic and Toxicologic Studies on N-N-Diethyltoluamide: I. N,N-Diethylm-Toluamide. A. M. Ambrose.* Toxicol. & Applied Pharmacol. 1:97 (Jan.) 1959. (*Army Chemical Center, Md.)

Since m-DET is an outstanding insect repellent, its present use on the skin of man and in the treatment of wearing apparel may be extended to use in cosmetics, food containers, and wrappers. Thus, study of the physiologic effects was made in detail. The acute oral LD_{50} for rats is 2.0 cc/kg. Intravenous doses of 50 mg/kg are not fatal in rabbits, but doses of 75 mg/kg are rapidly fatal. However, five daily injections of 25 mg/kg produced no cumulative toxic effects. Although single dermal applications of 2 or 4 cc/kg, held in contact with depilated intact or abraded trunks of rabbits for 24 hours produced mild to moderate erythema, they did not produce systemic toxicity. Repeated dermal applications for 13 weeks did not cause systemic toxicity but did cause mild to moderate dermal irritation, desquamation, coriaceousness, dryness of the skin, and fissures, which cleared up within three weeks of the last application. A 50% solution applied to the face and arms of five volunteer subjects for five consecutive days and to one subject for three consecutive days for six weeks caused some irritation and desquamation about the nose. Following dermal application, no sensitization was observed in guinea pigs. Although instillation into the eyes of rabbits did cause corneal damage, it was not permanent. Inhalation caused no systemic toxic reactions. Ingestion of 0.01, 0.05, 0.1, 0.5, and 1% in the diet for 200 days caused no sings of toxicity in rats.

The Subacute Toxicity of Four Organic Phosphates to Dogs. M. W. Williams,* H. N. Fuyat, and O. G. Fitzhugh. Toxicol. & Applied Pharmacol. 1:1 (Jan.) 1959. (*Food and Drug Administration, Washington, D.C.)

Subacute oral toxicity of Dipterex, Diazinon, Methyl Parathion and Chlorthion was studied in dogs for three months by following red blood cell and plasma cholinesterase levels. Dipterex produces significant depression in both plasma and red-cell cholinesterase within two weeks at 500 ppm, borderline depression at 200 ppm, and no depression at 50 ppm. The "no effect" level for Dipterex in the dog appears to be between 50 and 200 ppm. Chlorthion produces only questionable cholinesterase inhibition when in the total diet up to 15 ppm and no effect at lower levels. Methyl Parathion produces significant depression of both plasma and red-cell cholinesterase at 50 and 20 ppm. This toxicant tends to cause more cumulative effects than the others. No inhibition is seen at 5 ppm. Diazinon at 75 and 0.75 ppm produces significant lowering of plasma cholinesterase, while 0.25 ppm causes no effect. Only 75 ppm affect red-cell cholinesterase.

Studies on Aromatic Amines: I. Preliminary Observations on Benzidine Metabolism. W. Troll,* and N. Nelson. Am. Indust. Hyg. A. J. 19:499 (Dec.) 1958. (*New York University-Bellevue Medical Center, New York.)

A method of assaying amine metabolites is described which depends on the formation of a colored napthoquinone. The reaction seems to be generally applicable to free aromatic amines. The major metabolites of benzidine in the dog and rabbit appear to be the sulfate and glucuronide of 3hydroxy benzidine. No unesterified hydroxy derivatives or dihydroxy derivatives were found. Dogs excreted relatively more sulfate conjugate than rabbits. Dogs excreted more than 80% of the dose in the form of compounds with an available aromatic amino group, while rodents excreted less than 50%. Dog urines had a larger ether-extractable amine fraction containing unidentified amine metabolites. The method has also been applied to a preliminary survey of other aromatic amines.

Experimental Studies in Metal Cancerigenesis. X. Cancerigenic Effects of Chromite Ore Roast Deposited in Muscle Tissue and Pleural Cavity of Rats. W. C. Hueper.* A.M.A. Arch. Indust. Health 18:284 (Oct.) 1958. (*National Cancer Institute, Bethesda, Md.)

In 2 of 25 rats which received pleural cavity implants of chromite ore roast mixed with sheep fat, squamous-cell carcinoma coexistent with sar-

coma of the lung developed after two years. Of 31 rats which received right thigh muscle implants of the same material, 3 developed fibrosarcoma of the thigh, the first appearing after 10 to 12 months. These findings are interpreted as evidence for a carcinogenic agent in chromite ore roast. It is suggested that the acid-soluble, water-insoluble chromium compounds present in the roast exert a sufficiently strong and prolonged effect on exposed tissue to induce a neoplastic response without causing its necrosis by an acute corrosive action. An addendum reports the induction of sarcomas in 6 of 35 rats within five to six months after receiving implants of 25 mg. of synthetically prepared sintered calcium chromate containing only traces of other elements as evidence of a direct casual role of chromium in the production of cancer.

Medical Care Administration

Asa Barnes, M.D.

Major Medical Expense Insurance. C. A. Sigfried.* J. Am. Pub. Health A. 48:12 (Dec.) 1958. (*Metropolitan Life Insurance Company, New York.)

Major medical expense insurance is a recently developed mechanism for dealing with costs of medical care. It makes possible keeping the cost of medical care within manageable limits so that the family can deal with them without recourse to charity, government aid, or other subsidy. It has great flexibility to fit varying concepts of need and desire for the spreading of risk and sharing of costs. There is a great variation in the economic situation of the people who desire a means of dealing with these problems. A tremendously important group is composed of those who are employed or are members of a family whose head is employed.

The fact that major medical expense insurance plans do not aim to cover routine health checkups or routine preventive health services is not due to any lack of concern with such matters. It is based on the principle that there is no need to deal with relatively small expenditures by insurance and that to do so is wasteful and not in the public interest.

Major medical expense insurance does not claim to be the only mechanism for dealing with the cost of medical care, but it does claim a combination of qualities that will make it appeal strongly to rapidly growing numbers of people in the period ahead.

Compensations to the Physician in Occupational Medicine. E. L. Belknap.* J.A.M.A. 168:1847 (Dec. 6) 1958. (*561 N. 15th St., Milwaukee 3.)

Compensations to the physician in occupational medicine are the satisfactions derived from the practice of a wide range of scientific techniques, in situations often requiring the utmost in human understanding. Such practice can also have a firm economic foundation. In the field of occupational medicine the industrial physician must learn more and more about more and more.

A further satisfying reward for a physician in occupational medicine can be his sense of a personal contribution in the field of human relations. Through his day-by-day contact with workers, in his office and out in the plant, the men come to know that the physician in charge is primarily interested in their welfare and safety. Industry has also come to realize that the medical department can make or break the efforts of the entire personnel organization. Labor, meaning people, is the largest cost item in industry. Industries are accustomed to put a fair price on consultation in the field of engineering or invention. They are now learning to pay physicians in proportion to their skill and responsibilities, both as medical consultants and as potential experts in human relations.

A Guide for Medical Services for Construction Projects. Prepared by the ad hoc Committee on Medical Services for Construction Projects of the Council on Industrial Health, American Medical Association (Irving R. Tabershaw, and Joseph A. Quigley). J.A.M.A. 168:1961 (Dec. 6) 1958.

Many serious personal injuries occur on construction projects. Aside from the humane consideration of providing the best in medical care, the scope of medical services available may affect considerably the total cost of the project. Generally, at least 2% to 2½% of the total cost of construction is for workmen's compensation premium; some with poorer records are charged as much as two or three times the normal rate.

In addition to the medical and indemnity losses, there are the intangible factors, such as loss of time in travel to physicians' offices and interference with construction schedules. Accident prevention is the basic approach to the control of these losses, and the establishment of a competent medical service not only assists in the prevention of accidents but can minimize their ultimate ill effect in terms of the residual impairment of the injured worker and the monetary loss involved. Good placement examinations are strongly urged, and contracts which exclude them are to be discouraged. Construction projects are likely to be located in isolated areas and may involve problems of medical care not ordinarily encountered in other industries. Unusual features of the construction project should be considered and dealt with.

A qualified physician should be employed to direct all medical services at the job site. His functions are (*a*) supervising the medical department, (*b*) supervising first-aid facilities and personnel, (*c*) supervising the treatment of all occupational diseases and illnesses, (*d*) advising management on all medical policies and problems, (*e*) supervising job sanitation, (*f*) assisting in safety program, (*g*) conducting physical examination of workers, and (*h*) promoting health education and applying principles of health maintenance. Medical

staff and facilities required for the particular construction project should be provided.

The Troubled Employee. M. Golin. J.A.M.A. 168: 1371 (Nov. 10) 1958. (535 N. Dearborn St., Chicago 10.)

This article is from a special section, "Medicine at Work." It highlights the fact that the American Medical Association has established this year a joint committee on mental health in industry, made up of members and delegates of the councils on Mental Health and on Industrial Health to explore the general field of occupational psychiatry. Some of the questions concerning the troubled employee may be questions for the economist, the sociologist, or the administrator, but "they are also questions for the family doctor." A brief account is given of a few companies which have full time industrial psychiatrists. Reference is also made to the pioneering study of the Western Electric Company and its Hawthorne Works study.

It is also noted that the World Health Organization is launching a study of the effects of automation on mental health.

Dermatology

Donald J. Birmingham, M.D.

Penicillinase Therapy: Clinical Report of Severe Reactions. M. Reisch.* J.A.M.A. 169:594 (Feb. 7) 1959. (*104 E. 40th St., New York 16.)

It has been established that penicillinase, which is produced by bacterial cultures of various staphylococci, Escherichia coli, and Bacillus cereus, is an enzyme capable of destroying penicillin in vivo and in vitro. There have been several reports about its use as an effective treatment agent in patients who react allergically to penicillin. On the other hand, this report emphasizes that severe reactions to penicillinase have also taken place.

Two cases are presented. The first of these relates how a 35-year-old man who had been treated with penicillin developed generalized urticaria and arthralgia. One hour after receiving 800,000 units of penicillinase he experienced a severe chill, respiratory difficulty, and cyanosis, accompanied by a febrile episode. The urticarial lesions became more numerous. Steroid therapy provided almost complete relief within four days, but a persistent localized pain and swelling at the site of the penicillinase injection was noted.

In the other case, a 47-year-old man developed urticaria 10 to 12 days following a penicillin injection. He was treated with steroids and then given 800,000 units of penicillinase. At the site of the injection, local swelling and pain were accompanied by general lethargy, nausea, fever, and chills. He was in a semicomatose condition for 12 hours. Ten days later the same therapy produced the same symptoms and signs. It is recommended that extreme precaution be exercised in giving penicillinase to very young individuals, debilitated patients, or aged persons unable to cope with respiratory or cardiac embarrassment.

Abstracts

Cross-Sensitization in Diverse Poisonous Members of the Sumac Family. (Anacardiaceae). J. B. Howell.* J. Invest. Dermat. 32:21 (Jan.) 1959. (*414 Medical Arts Building, Dallas 1, Texas.)

Because of the common distributions of certain members of the botanical family Anacardiaceae and their known immunologic relationships, the author performed open and closed contact tests on known cases of ivy sensitivity with extracts of the following substances: poison ivy, poison sumac, cashew branches and leaves, cashew nut shell oil, Japanese lacquer tree, marking nut tree, marking nut, bhilawanol, and 3-pentadecylcatechol. In the first group of 23 individuals known to be sensitive to ivy, open tests produced several cross-reactions. In another group, constituting 27 known sensitive individuals, the same materials were applied as closed patch tests and provoked many more reactions than were noted in the open tests. From these studies, the author points out that tests with extracts must be done cautiously to avoid primary irritant effects; that the majority of the subjects allergic to poison ivy experience contact dermatitis after exposure to sumac, bhilawanol nut oleoresin, bhilawanol, cashew nut shell liquid, and the oleoresin of the lacquer tree. Since the open test with 0.1% 3-pentadecylcatechol failed to elicit cross-sensitivity in the majority of the test individuals, the author suggests a stronger concentration for open tests. The closed patch test was more consistent in producing cross-sensitivity reactions.

Are Your Gloves Right for the Jobs They're Doing? Occup. Hazards. 21:43 (Feb.) 1959. (Industrial Publishing Corporation, 812 Huron Road, Cleveland 15.)

This article deals with the proper choice and use of gloves for industrial personnel. The supplying of gloves can be a costly procedure, particularly if they have been ill chosen for jobs in which they are unable to bear the brunt of continual usage. The role of gloves in lowering the incidence of injury to the hands is exceedingly important, since hand injuries constitute 7% of all injuries reported to state compensation boards each year. An equally important aspect in the use of gloves is their role in preventing occupational dermatitis. This survey encompassed studies in 233 different plants, in which were purchased 1,064,000 pairs of canvas gloves, 204,500 pairs of rubber gloves, and 385,000 pairs of coated gloves. Several pictures illustrate the appropriate type of glove for certain jobs. Included also is a list of chemicals, accompanied by a statement of the suggested glove for handling the chemicals.

Primary Irritant and Allergic Eczematous Reactions: Their Interrelations. A. Rostenberg, Jr.* A.M.A. Arch. Dermat. 75:547 (April) 1957. (*Dept. of Dermatology, University of Illinois College of Medicine, Chicago.)

Abstracts

The author presents a review of the pathogenesis, biochemistry, and some theoretical considerations involved in primary irritant and allergic eczematous reactions on the skin. Differentiation is made between primary irritants of immediate and of cumulative nature. It is emphasized that the eczematous skin lesions caused by contact with a primary irritant substance can be morphologically and histologically equivalent to those produced by a sensitizer. The primary irritant response is not based on an immunological effect, whereas the sensitizer requires certain immunologic factors to be present in the host for its effect to occur. Material is presented with reference to the genesis of allergic sensitization, namely, the genetic makeup of the host, the intrinsic allergenicity of the compound, adjuvant factors which may influence specific sensitization at any given time, quantitative factors, and the detection of sensitivity when it occurs.

Description of the pathology of the eczematous reaction stresses the requirement of spongiosis within the epidermis. Biochemical considerations dealing with enzyme systems plus alterations in capillary permeability may lead to the eventual clinical and histological manifestations of the disease. Finally, it is pointed out that in spite of all that is known about primary irritant and sensitivity reactions of eczematous character, there are many points requiring further investigation.

Lithographer's Dermatitis. H. M. Levin,* M. J. Brunner, and H. Rattner. J.A.M.A. 169:566 (Feb. 7) 1959. (*607 Walworth Avenue, Delavan, Wis.)

Dermatitis affects about 5% to 10% of the 30,000 employed in the lithograph trade. This investigation concerned itself with the causes of dermatitis and the methods of prevention existent among 100 men representing the major employment pursuits in the lithography trade. Of this group, 76 men had active eruptions during the study or at some previous time, and these were compared with 24 others who were free of any dermatitis. The various segments found within this trade are defined, and the numerous contact agents met with in these segments are noted. Chromated albumen, numerous etching compounds, inks, roller washes, solvents, acids, and alkalies are included in the list of irritants and sensitizers. The most notorious sensitizer is the chromium compound used for treating the plates. The pressmen and platemakers who constituted over 75% of this study group have contact with most of the above-mentioned chemicals. The authors emphasize the fact that the numerous irritants handled in lithography probably facilitate the inception of allergic dermatitis because trauma plus the action of solvents, acids, and alkalies aids in bringing about a vulnerable skin. Protective creams of all types have been tried, with little success. It is suggested that better industrial hygiene techniques be established to minimize contact, that efforts be made to develop nonirritant and nonsensitizing substitutes, and finally that more study be given to neutralizing or chelating the chromium contacted in this trade.

Reparative Surgery

Robert J. Trettin, M.D.

Debricin: Clinical Experiences with a New Proteolytic Enzyme in Surgical Wounds. J. F. Connell, Jr.,* L. R. M. DelGuercio, and L. M. Rousselot. Surg. Gyn. & Obst. 108:93 (Jan.), 1959. (*Surgical Service, St. Vincent's Hospital, New York)

The properties for an ideal wound debridement agent may be listed as follows: (1) The enzyme should be capable of rapid lysis of fibrin, denatured collagen, elastin, and exudate; (2) it should be completely inactive in contact with normal human tissue; (3) It should be nontoxic on absorption and nonirritating to the wound; and (4) it should be easily prepared, stable, and readily applicable to most lesions. In seven years of evaluating many materials, the authors report, debricin used in a variety of surgical lesions in 139 patients has best fulfilled these requirements. This enzymatic agent was developed from the ficin latex of the fig tree. While highly active against fully denatured protein, the material is only partially active on marginal necrotic tissues. Used topically, debricin is nontoxic, with little evidence of wound maceration. When properly applied to maintain contact with the denatured tissue substrate, debricin provides rapid, complete debridement. The conditions for healing are thereby improved by its cleansing activity, and appropriate surgical procedures to obtain wound closure should follow when indicated. Antibiotics should be used during the course of therapy.

Skin Suture Marks. G. F. Crikelair.* Am. J. Surg. 96:631 (Nov.), 1958. (*Division of Plastic Surgery, Department of Surgery, Presbyterian Hospital and Columbia University, New York)

The possible factors in the formation of suture marks may be an inherent keloid tendency, the occurrence of stitch abscesses, the body area being sutured, the type of suture material employed, the size of the suture material and needle, and the tension of a suture on a wound. Tension, both intrinsic and extrinsic, is the most important. It is noted that, with the exception of tension, the variables are not always controllable by the surgeon.

Although nonabsorbable sutures are preferable for skin closure, the type of nonabsorbable material may always remain a matter of personal preference. The technic of wound approximation is much more important than the type of suture material. The size of suture material or needle is not a cause of suture marks per se, but heavier material may permit application of excessive tension. Usually, with the wound undermined as necessary and immobilized, properly placed

sutures without tension can be left until the seventh day without causing suture marks. Even with excessive tension, earlier removal of sutures may prevent marks but support to the wound for a longer period is advisable.

Strangulated Internal Hernia Associated with Trauma. C. J. Mock* and H. E. Mock, Jr. A.M.A. Arch. Surg. 77:881-886 (Dec.), 1959. (*122 S. Michigan Blvd., Chicago)

Mesenteric and omental defects are usually developmental, occasionally inflammatory, and rarely traumatic in origin. A case of strangulated transomental hernia is the first reported instance of transomental hernia in which both defect and hernia were attributed to injury. The patient, a surgeon, and the authors' father, had sustained fractures of his sternum and ribs in an automobile accident three weeks prior to acute abdominal symptoms. Resection of about 4 ft. of gangrenous small intestine was successful in spite of several complications. Also reported is a case of strangulated transmesenteric hernia. Trauma sustained while strenuously chopping wood apparently precipitated the condition. The etiological mechanisms of these hernias is not entirely clear but primarily involves incarceration. This explains the high incidence of strangulation and gangrene. A precise diagnosis, beyond that of intestinal obstruction, has never been made preoperatively in any of the collected cases. A high index of suspicion and early surgical intervention are essential for successful treatment.

The Management of Trauma in the Aged. P. H. Taylor, D. K. Heydinger, and L. C. Roettig.* Am. J. Surg. 97:63 (Jan.), 1959. (*9 Buttles Ave., Columbus 8, Ohio)

The authors present a plan formulated to manage cases of trauma in the aged.

Step 1—The patient is attended immediately and all emergency procedures, such as hemostasis management of shock and establishment of an adequate airway, are performed. Fluid and electrolyte management is started immediately.

Step 2—A complete history is obtained, and physical examination is made.

Step 3—At this point the initial evaluation of the patient should be made and the course of treatment charted.

Step 4—To evaluate the organ systems quickly, one laboratory procedure is performed on each of the major systems. The initial studies consist of (1) complete blood count, (2) urinalysis, (3) blood urea nitrogen determination, (4) prothrombin time determination, (5) electrocardiography, (6) chest x-ray film, and (7) blood sugar determination.

The paper details the application of this basic plan and reports on a series of 35 consecutive elderly trauma victims, showing the results of their management by the trauma plan. In a comparative study for further evaluation, the percentage of complications was significantly lowered and the days of hospitalization reduced almost 50%.

Nonpenetrating Abdominal Trauma. G. V. Pontius,* B. C. Kilbourne, and E. G. Paul. A.M.A. Arch. Surg. 72:800 (May), 1956. (*Department of Surgery, Northwestern University, Chicago)

Of the injuries of proved diagnosis, 36% involved the spleen, 36% the gastrointestinal tract, and 12% the liver, and 16% were multiple injuries, including three major vascular catastrophies. Records of 47 patients presenting nonpenetrating trauma are discussed relative to mechanism of injury and associated injuries. Improvement in the mortality rates of patients with abdominal trauma will depend on (1) earlier admittance to the hospital, (2) rapid restoration of blood loss, (3) early exploration on the basis of reasonable suspicion of isolated intra-abdominal injury, (4) careful evaluation of the abdomen in presence of multiple injuries, (5) use of modern restoration vascular techniques, (6) vigorous treatment of air passages in associated chest injuries, and (7) appropriate antibiotic and electrolyte therapy.

Internal Medicine

Shermer H. Stradley, Jr., M.D.

Cardiac Arrhythmia in Chronic Cor Pulmonale. L. J. Corazza,* and B. H. Pastor. New England J. Med. 259:862 (Oct. 30) 1958. (*Chief, Medical Service, St. Joseph's Hospital, Hazelton, Pa.)

Cardiac arrhythmias have heretofore been considered rare in chronic cor pulmonale. The authors reviewed the records of 122 patients with chronic cor pulmonale and without evidence of heart disease of other etiology. Thirty-one per cent had one or more arrhythmias. The types and numbers of cases of each type are tabulated.

Stimuli for arrhythmias arise from pressure receptors in the right cardiac chambers, the great veins, and the pulmonary arteries and the lungs. Increased pressure in the right heart chambers is frequently present in chronic cor pulmonale, and the electrocardiogram shows tall, peaked P. waves and evidence of right ventricular strain and hypertrophy. Cardiac arrhythmias may be initiated by the stretch reflexes in the lungs, pleura, trachea and bronchi. Reflexes other than the stretch reflex (Hering-Breuer) exist. Increased pulmonary artery pressure, such as occurs with pulmonary embolism, may reflexly stimulate cardiac arrhythmias.

The authors conclude that arrhythmias occur frequently in chronic cor pulmonale and that their development is enhanced by infection with its associated bronchospasm, hypoxia, and hypercapnia.

Syncope in a Population of Healthy Young Adults: Incidence, Mechanisms, and Significance. G. Dermksian,* and L. E. Lamb. J.A.M.A. 168:1200 (Nov. 1) 1958. (*422 W. 115th St., New York 25.)

Abstracts

The authors studied 82 persons with 113 syncopal attacks. The mechanisms resulting in syncope were classified as (1) venous—inadequate blood return to left heart—both systemic and pulmonary; (2) cardiac—ineffective pumping action; (3) loss of arteriolar tone—change in routing of blood flow; (4) blood qualitative changes—abnormalities in the constituents of circulating blood; (5) blood quantitative changes—inadequate circulating volume; (6) central nervous system—local disorders.

In experimental syncope, there was a high incidence of cardiac arrhythmias, the majority of which were induced by such maneuvers as breath-holding or hyperventilation followed by breath-holding.

It is thought that respiratory stimulation of the vagus nerve, known as the pulmonary stretch reflex mechanism, induces a cardioinhibitory response. This reflex can be abolished by atropine. The role of the stretch reflex in syncope and the means of abolishing it have a definite application in industry and medicine.

Interpretation of Hematologic and Serologic Findings in the Diagnosis of Infectious Monomucleosis. C. E. Bender.* Ann. Int. Med. 49:852 (Oct.) 1958. (*University of Washington Health Center, Seattle 5.)

The basic screening procedure in the diagnosis of infectious mononucleosis is the identification of atypical lymphocytes. Recognition of these cells is rendered easier when blood smears are made about half the usual thickness. In well-stained thin smears in the early part of the illness, atypical lymphocytes are easily identified; later, identification is more difficult. In only rare instances is infectious mononucleosis accompanied by less than 20% atypical lymphocytes during the high febrile phase. Neutrophile percentages consistently over 49 are seldom encountered in the disease. A positive heterophile test—that is, 1:56 or higher with unabsorbed serum—in a patient with a consistently normal differential count suggests that the illness is not infectious mononucleosis.

The author discusses briefly the usual clinical findings of the disease and outlines in detail the Heterophile antigen tests and how they should be applied in given cases.

Acute Pancreatitis: A Clinical Review of 72 Attacks Occurring in 54 Patients. P. L. Shellenberger,* and D. F. Kapp. Ann. Int. Med. 48:1185 (June) 1958. (*Guthrie Clinic, Sayre, Pa.)

The initial diagnosis of acute pancreatitis is missed in 65% to 75% of cases, in spite of the elaborate tests for pancreatic dysfunction that have been devised. The two conditions most frequently confused with pancreatitis in the series presented were acute biliary colic and penetrating or porforating peptic ulcers.

Pain varying from moderate to severe, usually boring in character and frequently radiating to the subscapular region from the mid or right epigastrium, occurred in the majority of patients. One patient presented with substernal pain mimicking acute myocardial infarction. Nausea and vomiting were present in all but nine attacks.

The diagnosis depends on a significant elevation of either serum amylase or lipase. It is important to consider the diagnosis of pancreatitis early in order not to diminish the value of these tests as confirmatory evidence. The authors suggest a scout-film of the abdomen, which may reveal localized small bowel ileus, and a chest film, which may show "plate-like" atelectasis in the lung bases.

Jaundice occurred in 21 of the reported cases; 17 of these later were found to have acute cholecystitis with stones, choledocholithiasis, or stricture of the common duct. The serum bilirubin was elevated in these cases. Whether the jaundice was due to edema of the head of the pancreas or to a coexisting hepatitis or cholangitis remains in doubt.

Twenty per cent of the 45 survivors developed permanent diabetes mellitus.

The authors believe that medical management is preferred and the suggested medical approach is outlined.

Onycholysis in Hyperthyroidism. M. N. Luria, and S. P. Asper, Jr.* Ann. Int. Med. 49:102 (July) 1958. (*The Johns Hopkins Hospital, Baltimore 5.)

The purpose of this paper is to call attention to the phenomenon of onycholysis which occurs in some patients with hyperthyroidism. In healthy nails, there is a distal convexity of the curvilinear junction of the nail from its bed. In onycholysis, there is a reversal of this curve; thus, beneath the end of the nail an additional free space remains in which debris may collect. These changes most frequently occur in the fourth finger. The phenomenon may also affect the toe nails. In the authors' experience, these changes were observed only in diffuse goiter with hyperthyroidism, apparently rarely being seen in hyperfunctioning adenomatous goiter. Exophthalmus may or may not coexist. The changes are reversible, and the nails return to normal when the patient becomes euthyroid. Similar changes have been noted in hypothyroidism, syphilis, and chronic arthritis, in fur workers, and in persons with injured nails.

The authors have enhanced their description of onycholysis with several excellent photographs illustrating the nail changes before and after treatment.

It is concluded that onycholysis occurs with sufficient frequency to alert the physician to the possible existence of diffuse goiter with hyperthyroidism.

[*Correction:* The final sentence of the abstract of the article "Acute Pericarditis After Smallpox Vaccination," by V. F. Cangemi, published in the February, 1959, issue was an editorial comment which should have been marked to indicate that it had no connection with the article abstracted.]

Abstracts

Noise and Hearing

H. O. Parrack, Ph.D.

This article is general in nature and outlines the current research activity pertaining to the relation between noise exposure and hearing loss. Specifically, it outlines the problems of (1) noise measurement, (2) noise exposure control, (3) auditory effects of noise, and (4) nonauditory effects of noise.

Electra Acoustical Program. C. T. Malloy.* Noise Control 5:7 (Jan.) 1959. (*Lockheed Aircraft Corporation. Burbank, Calif.)

The industrial medical specialist is frequently asked about the noise levels around particular aircraft during operation on the ground and during flight operation. This article describes the acoustical program associated with the development of the Electra aircraft and furnishes the following noise level data: (1) the over-all sound pressure levels at 200 feet from the aircraft when operated at high ground idle and low ground idle; (2) the over-all sound pressure levels, average for all directions, at various distances from the aircraft up to ¾ mile; (3) the change in sound pressure level for each octave band, measured 200 feet from the aircraft, when operated at power settings of "low idle" and "high idle"; (4) limited data on the sound pressure level on the ground under the aircraft during takeoff operations. These data will be useful to the industrial medical specialist in estimating the need for protection of personnel working near this aircraft and will also provide limited information about noise levels to which residents of communities under the flight path may be exposed.

Noise Characteristics for the Boeing 707. R. M. Gibbs* and H. H. Howell. Noise Control 5:13 (Jan.) 1959. (*Boeing Airplane Company, Renton, Wash.)

Turbojet-propelled transport aircraft are coming into use for passenger transportation. The power plants of these aircraft generate sound pressure levels that create problems for preserving the hearing function of maintenance personnel. The industrial physician of the operating airlines will require information about the sound pressure levels near the aircraft in order to establish appropriate hearing conservation programs. This paper presents sound pressure level data for the 707 transport when operated on the ground and during take-off, with and without the noise suppressor. The noise suppressor reduces the sound pressure levels but not sufficiently to remove the requirement for protecting the hearing of maintenance personnel and perhaps other personnel working on the airport. Most of the data given pertain to take-off operations and therefore show the contribution of these operations to the general noise levels on the airport. The sound pressure levels generated by this aircraft are compared with those produced by several propeller aircraft, and these data will be of value to the industrial physician in determining the relative importance of the problem of hearing conservation generated by the two different types of aircraft.

Current Research and Industrial Noise. A. Glorig.* Noise Control 5:32 (Jan.) 1959. (*Research Center, 111 North Bonnie Brae St., Los Angeles 26.)

Some Industrial Noise Problems and Their Solutions. L. J. Williams.* Noise Control 5:36 (Jan.) 1959. (*Bolt, Beranek and Newman, Inc., Cambridge, Mass.)

This article is concerned with everyday industrial noise problems. Disturbances to people living around the industrial plant and the problems of hearing protection are considered in relation to the noise output of industrial operations. Some examples of noisy industrial operations are given, together with the means developed to reduce the noise from these operations.

Field and Laboratory Examples of Industrial Noise Control. A. L. Cudworth.* Noise Control 5:39-43, 73 (Jan.) 1959. (*Liberty Mutual Insurance Company, Boston.)

This article deals with the practical problem of reducing the noise produced by industrial operations. Noise levels attending the several operations studied are given, together with descriptions of the action taken to reduce the noise and the amount of noise reduction achieved.

Foundry Noise. H. J. Weber.* Noise Control 5:44 (Jan.) 1959. (*American Foundrymen Society, Des Plaines, Ill.)

This article describes noise levels attending many of the operations carried on in a foundry. It also describes a variety of treatments used to reduce the noise from these operations and gives data on the amount of noise reduction obtained.

Noise Suppressors for Jet Engines. E. E. Callaghan.* Noise Control 5:18 (Jan.) 1959. (*Lewis Flight Propulsion Laboratory, NACA, Cleveland.)

Turbojet aircraft engines produce noise levels that may adversely affect the hearing of maintenance personnel and disturb the residents of communities surrounding airports. These problems have led to major attempts to produce noise suppressors that will significantly reduce the sound pressure levels produced. This article discusses noise suppressor development, gives some information about the amount of noise reduction achieved, and estimates the amount of noise reduction that can be anticipated in the near future. The data will assist the industrial physician in evaluating the hearing conservation problems that attend the operation of turbojet aircraft engines.

Airports and Jet Noise. L. N. Miller,* L. L. Beranek, and K. D. Kryter. Noise Control 5:24 (Jan.)

Abstracts

1959. (*Bolt, Beranek and Newman, Inc., Cambridge, Mass.)

This article summarizes the data on the noise levels produced by several jet propelled transport aircraft that are now in operation. Particular interest attaches to Figures 1, 2 and 3, which contain data comparing turbojet aircraft noise levels with certain criteria for risk of damage to the hearing organ. In addition, the noise levels in the areas surrounding the aircraft, for various ramp operations and for take-off operations, are given. These data should be of value to industrial physicians in planning immediate hearing conservation programs and in estimating the extent of the industrial hearing hazard that will accompany the more extensive use of turbojet transport aircraft.

Industrial Hygiene

Edward C. Riley, M.D.

Calibration of Alnor Velometers. George M. Hama.* Am. Indust. Hyg. A. J. 19:477, 1958. (*Bureau of Industrial Hygiene, Detroit Department of Health.)

Because of the wide application to the Alnor Velometer as a convenient direct-reading instrument for evaluating the performance of exhaust ventilation hoods, it is important to recognize the limitations of the instrument and some of the practical difficulties inherent in the instrument. This article points out some of the pitfalls and explains the need for frequent calibrations as well as outlining a technique which can be used to check the calibration of these instruments. One of the difficulties in evaluating local exhaust hoods is the relatively low air velocities (50 to 250 ft/min) which are commonly encountered at the face of local exhaust hoods. Because of the low velocity and fluctuations over the face hoods, it is difficult to obtain accurate measurements with ordinary air-flow-measuring instruments such as the Pitot tube or even the vane anemometer. The following limitations are pointed out:

"1. It is doubtful if readings with the Velometer over all ranges can be made closer than within a ± 5% error—even under laboratory conditions.

"2. If a single reading is made at an exhaust opening, the error may be as great as 50 to 100%.

"3. Any instrument that has been dropped or subjected to contaminated and corrosive atmospheres should be re-calibrated since a small flow of air takes place through the Velometer.

"4. Under no circumstances should a Velometer exhaust jet be used for measuring flow or calibration by placing the exhaust jet within the duct downstream from the exhaust opening.

"5. It is important that the device is held . . . so it does not block the air stream or cause turbulence at the point of calibration."

In discussing the method of calibration, the author has presented some plans for experimental exhaust system which he has found satisfactory for the calibration of low-velocity jets on the Velometer. He also points out that both the Velometer and the jets have certain cross sectional areas and indicates that this instrument should not be used when the instrument or jet area is more than approximately 3% of the cross sectional area of the hood to be tested. Allowing for a little turbulence around the instrument, this would generally keep the results within ± 5%.

"If the density of air varies appreciably from standard air (.075 lb/ft^3 dry air at 70°F and 29.92 inches Hg barometer) corrections should be made both for the Pitot tube readings and the Velometer calibration." He also points out that "corrections should be made where changes of 5% or more in density occur."

Respirators—Selection, Use and Care. Michigan's Occupational Health, Vol. 4, No. 2, Winter, 1958.

Again the Michigan Department of Health has called attention to the very old and accepted piece of equipment, the respirator, used to protect workmen against gases, dusts and fumes. In addition to calling attention to the many types of physical and chemical problems to be considered and the importance of proper face fit, the author points out the need for a continuing training and maintenance program to make this equipment effective. Perhaps the most useful information contained in this bulletin is the table in the center page which lists the respirators approved by the Bureau of Mines. This not only contains the types of approvals issued by the Bureau of Mines but lists the manufacturers along with approval number for each type of equipment for which the Bureau of Mines has established an approval list. Such information is invaluable to safety and industrial hygiene engineers who may have the responsibility for recommending suitable equipment for production personnel and who might otherwise be at the mercy of the equipment salesmen. It is encouraging to see this sort of information brought up to date and distributed in a readily available form.

Under the title "Old Chestnuts in Occupational Health" a number of common industrial hazards are briefly discussed along with some of the information on toxicity and source of exposure and the current MAC. Data on mercury, zinc, cadmium, and beryllium are nicely summarized in this issue of the quarterly publication. Although all of these materials have been and are being safely used in industry, continued vigilance and follow-up are required to prevent unsuspected occupational exposures.

A Dynamic Apparatus for Preparing Air-Vapor Mixtures of Known Concentration. R. F. Scherberger,* G. P. Happ, F. A. Miller, and D. W. Fassett. Am. Indust. Hyg. A. J. 19:494, 1958. (*Eastman Kodak Company, Rochester, N.Y.)

The authors list eight features of the apparatus which will appeal to many:

"1. First, there is an abundant and continuous supply of the mixture.
"2. Swift changes in concentration are effected by altering either the temperature or rate of feed of the liquid being vaporized or by changing the air flow rate. Such changes require only a few minutes compared with the half hour or more needed to effect a similar change in a five-bottle static system.
"3. Purging is normally very simple since a dynamic system reaches equilibrium rapidly. The time in minutes (t_{99}) required to purge to 99% freedom from vapor can be calculated from the equation:

$$t_{99} = \frac{4.605 \times \text{chamber volume in liters}}{\text{liters/minute thru chamber}}$$

This is also the time required to reach equilibrium after a concentration change.
"4. Concentrations are easily controlled within the limits normally required by the industrial hygienists.
"5. In animal exposure experiments, a dynamic system assures ample oxygen supply and sweeps waste respiratory products from the chamber.
"6. The adsorption problem is negligible since vapor adsorbed on the walls reaches equilibrium with vapor in the air stream.
"7. Such an apparatus can be very compact, requiring little space in the laboratory.
"8. Finally, because of its flexibility and convenience, laboratory personnel are encouraged to use a dynamic system as an everyday tool."

Tunneling Operations in Massachusetts—Hygienic Aspects. E. M. Caproni* and Leonard Pagnotto. Am. Indust. Hyg. A. J. 19:489, 1958. (*Division of Occupational Hygiene, Massachusetts Department of Labor and Industries, Boston.)

This study of the industrial hygiene hazards involved in two large tunneling operations in the Boston area shows the kind of control that can be accomplished with cooperation between the construction company and a state agency.

The two tunnels were each about 7 miles long and had outside diameters of 14 to 15½ ft. with inside diameters of 10-11 feet. Studies were made of atmospheric concentrations of dust, carbon monoxide, and oxides of nitrogen during tunneling operations and later during operation of Diesel locomotives for haulage underground.

The authors conclude that "the dust hazard from drilling was adequately controlled by the use of wet drills and a minimum ventilation rate of 1200 cfm per drill (6000 cfm for 5 drills). This was also adequate ventilation to clear the heading of blasting gases within 25 minutes after each blast.

"The operation of Diesel haulage equipment did not present a real health hazard as long as the recommendation of the Division of Occupational Hygiene were followed. Aldehydes from Diesel engines did present problems at times, but was reduced by keeping the scrubbers at maximum efficiency."

Abstracts

Clinical Toxicology

Lee H. Miller, M.D., I.M.D.

Arseniuretted Hydrogen Poisoning in Tank Cleaners. A. T. Doig. Lancet 2:88 (July 12) 1958.

Arseniuretted hydrogen (arsine) is an extremely toxic gas that is evolved from arsenic in the presence of nascent hydrogen. Arsenic is frequently present in commercial grades of metals, sulfuric and hydrochloric acids, and other acids made from sulfuric acid. Poisoning has occurred in many industrial processes, including the smelting and refining of many metals, chemical, fertilizer, paper manufacture, dying, electroplating, and others. The MAC for an eight-hour work-day is 0.05 ppm.

Arsine combines with hemoglobin and causes hemolysis of the red cells. The sudden onset of severe illness with gastrointestinal symptoms associated with the voiding of dark urine (hemoglobinuria) is sufficient to direct attention to the possibility of poisoning by arsine. Jaundice and anemia are produced quickly, and altered liver function and characteristic evidence of a lower nephron nephrosis may be observed as the body attempts to eliminate the products of the disintegrated corpuscles. The results obtained by treatment with BAL 2,3-dimercaptopropanol have been unconvincing, and the prognosis is related generally to the amount of urine excreted. Supportive therapy may include careful fluid balance, transfusions, and prevention of hyperkalemia.

Three cases (one fatal) are described that resulted from exposure to arsine during the cleaning of tanks that held acids.

Effect of Breathing 100 Per Cent Oxygen Upon Visual Field and Visual Acuity. E. F. Miller.* J. Aviation Med. 29:598 (Aug.) 1958. (*U.S. Naval School of Aviation Medicine, Pensacola, Fla.)

Temporary effects upon visual fields, visual acuity, and reductions in blood flow in retinal arteries during the breathing of oxygen for prolonged periods under certain conditions have been observed. Since pilots often use 100% oxygen, it was considered important to know whether hyperoxia might reduce the efficiency of a pilot by means of physiologic or functional visual changes.

The effect of breathing 100% oxygen for approximately four and one-half hours upon the visual field and upon the visual acuity of six subjects was investigated. A control study was made by having the subjects breathe air instead of the 100% oxygen during the test run. Analysis of the data from oxygen-breathing tests and comparison of them with the data from air-breathing tests revealed no significant depression or constriction of the central field and no sector defects; the size of the blind spot also remained essentially the same. A lack of significant alterations of the more peripheral isopters indicated no decreased sensitivity in this region. Central acuity was unchanged,

Abstracts

and peripheral acuity during the 100% oxygen-test run at both 5 degrees and 10 degrees did not differ significantly from that measured during the air-test run. The results indicate that vision tested in several regions from 0 to 60 degrees suffers no apparent decrement as a result of the breathing of 100% oxygen at atmospheric pressure for a period of over four hours.

Dysbarism Manifested by Anterior Spinal Artery Syndrome: Further Report of a Case with Recovery. O. Höök.* J. Aviation Med. 29:540 (July) 1958. (*Neurological Clinic, Serafimerlasarettet, Stockholm, Sweden.)

Lesions of the spinal cord due to rapid decompression are well known in divers and caisson workers but seem to be very rare in airmen. A test pilot developed abdominal distention and pain at a simulated altitude of 40,000 feet. Sensory aberrations developed quickly in the upper and lower extremities. Ten minutes after the descent, he was unable to move his legs and had a considerable loss of strength in both arms. Moderate shock developed within the next few hours, and vesical and rectal paralysis were present from the onset. Deep venous thromboses occurred, which were treated with anticoagulants. Two days after the chamber accident, a tendency toward voluntary innervation in the left great toe was noted. Active physical therapy was instituted, and the patient improved slowly. Approximately six months later he was able to walk without support, and in two years he returned to flying duty as a co-pilot. From the clinical picture, the anterior spinal artery in the lower cervical segments was affected. It is speculated that vascular spasm, in addition to possible gas emboli, may have contributed to the production of the syndrome. The case emphasizes the value of intensive rehabilitation procedures.

The Treatment of Exposures to Thorium and Uranium with a Chelating Agent and Supportive Measures. W. N. Young, and H. A. Tebrock. Indust. Med. & Surg. 27:229 (May) 1958.

Four persons were injured severely and five received minor injuries when 40 pounds of thorium dioxide and a small quantity of uranium dioxide exploded. The various types of trauma sustained by the seriously injured patients included second and third degree burns, fractures, and chest and head injuries. Since uranium and thorium are primarily alpha emitters, surface contamination of the skin was of little consequence and the offending agents were removed by washing with soap and water. Absorption was thought to have occurred by injection, inhalation and ingestion. Edathamil (ethylenediaminetetraacetic acid; EDTA) was administered intravenously to ameliorate damage to the kidney tubules and to prevent deposition of thorium in the bones. Graphs are presented which show the amounts of thorium and uranium excreted in the urine. Burns were treated by both open and closed methods. Other therapy included antibiotics, transfusions, intravenous fluids, tracheotomy, and the grafting of skin. One patient died. The authors conclude that edathamil merits consideration in the therapy of uranium and thorium damage.

Mental Health

Graham C. Taylor, M.D.

Tensions of Executive Life—Management Analysis. Research Institute of America, Inc., 589 Fifth Avenue, New York 17.

This brochure presents an interesting account of the tensions of executive life. Its headings are as follows: Facing The Fact of Tension; The Anatomy of Tension; Understanding Your Own Tensions; Controlling Your Tensions. It is expressly for executives in terse, brief, and lucid form.

Reprints can be obtained by writing to the address given.

Good with People. P. Stryker. Fortune Magazine, Dec., 1958, p. 104.

This is the fifth in a series of articles by Perrin Stryker, who is on the Board of Editors of Fortune Magazine, on the executive qualities. This particular article gives the notes made by a consultant who had been requested to recruit for the president of a company a particular manager who would best fit in with the company structure and with the top management personnel. The article gives some sidelights on the process which this procedure involves and on the insights and wishes of the management consultant.

Woe and Work. Editorial, J.A.M.A. 168:1377 (Nov. 10) 1958.

This article states: "It is a fact that accidents, gold-bricking, excessive work absence, trouble making, and other signs of employee maladjustment cause a tremendous dollar loss in industrial output." The editorial makes reference to the fact that there may be a direct impact of "off-the-job disturbances" on the work group, which, whether manifested at work in gripes said aloud or in deep-seated suspicions smoldering silently—carry a germ of communicability which might infect co-workers as surely as a sneeze might infect them with the common cold.

Management in the 1980's. H. J. Leavitt, and T. L. Whisler. Harvard Business Rev. 36:41 (Nov.-Dec.) 1958.

The main thesis of this article is that with increasing advances in the technology of information flow—including methods of processing data, such as by the high speed computor, the use of mathematical methods concerning decision making tasks and by methods such as those employed in operations research—all these will lead to an altercation in the very nature of management.

Briefly, the authors predict that (1) the dividing line between planning and performance will be moved upwards in the industrial pyramid; (2) industrial organizations will reverse the present trend toward decentralization and begin to recentralize; (3) many of the present middle management positions will become obsolete or at least will move downward; and (4) there may well develop a small group of managerial, planning, and programming elite.

By way of illustration of the change in middle management function, the authors cite an example of a public utility company. Previously, decisions concerning generating capacity changes were made by the station managers, whereas they are now made by computor programming, taking into account many complex changes in the advancing patterns (with reference to employment of air conditioning in hot summer afternoons). In short, then, there will be a few middle managers and those who survive will be primarily technicians rather than decision makers.

The authors further state: "One can imagine major psychological problems arising from the depersonalization of relationships within management and the greater distance between people at different levels. Major resistances should be expected in the process of converting relatively autonomous and unprogrammed middle-management jobs to highly routinized programs."

In summary, "The organization chart of the future may look something like a football balanced upon the point of a church bell. Within the football (the top staff organization), problems of coordination, individual autonomy, group decision making, and so on should arise more intensely than ever. We expect they will be dealt with quite independently of the bell portion of the company, with distinctly different methods of remuneration, control, and communication."

Free Silica Dust Concentrations Measured in Nine Brick Manufacturing Plants. W. J. Schreibeis,* and L. Schreibeis. Am. Indust. Hyg. A. J. 19:485, 1958. (*Industrial Hygiene Foundation, Pittsburgh.)

In comparing the dust concentrations reported in this report with those reported for the silica brick industry of Pennsylvania in 1939, the similarity in order of magnitude of dust exposures is striking.

In view of the high incidence of silicosis (51.9% of 1,035) found in a "Study of Silicosis in the Silica Brick Industry" in Pennsylvania 20 years ago it would be interesting to know the physical findings of the workers in the nine plants in the recent survey. The earlier study also indicated an over-all incidence of 11.9% tuberculosis in the 1,035 workers, with an incidence of 22.9% in the 538 persons diagnosed as having silicosis. Silicosis was found among all groups exposed to more than 2,000,000 particles per cubic foot in the earlier study of the silica brick industry.

In view of the fact that several exposures "were found to be higher than desirable, it is unfortunate that the opportunity to check the effectiveness of the dust control measures has not been obtained" up to the time of this report. A complete study of these workers should do much to establish confidence in the current standards and resolve existing confusion concerning threshold levels.

Radiation Health

Thomas S. Ely, M.D.

Irradiation of the Entire Body and Marrow Transplantation: Some Observations and Comments. E. Donnall Thomas,* Harry L. Lochte, Jr., and Joseph W. Ferrebee. Blood 14:1-23 (Jan.), 1959. (*Mary Imogene Bassett Hospital, Cooperstown, N.Y.)

It has been repeatedly demonstrated that some animals can be protected from a lethal dose of ionizing radiation by a subsequent transfusion of normal bone marrow cells. Certain laboratory animal leukemias can be cured by this means. Human attempts have been discouraging to date. Several sources of failure may be postulated. If the host is given insufficient radiation, enough immunological activity will remain to reject the transplant. The transplant itself may possess sufficient immunological powers of its own to prevent a successful take. This is true of adult material and may dictate a fetal source. Marrow cells are deficient in lymphopoietic elements. The radiation doses were probably not uniform, some gaps and some overlapping having been produced.

Determination of Thorium in Urine. George A. Welford,* Doris C. Sutton, Robert S. Morse, and Seymour Tarras. Am. Indust. Hyg. A. J. 19:464-468 (Dec.), 1958. (*Health and Safety Laboratory, U. S. A.E.C., 70 Columbus Ave., New York)

Although the urinary excretion rate of thorium is probably not a good index of exposure level, it is frequently used as a guide to indicate that exposure has taken place. Determination with adequate sensitivity can be performed spectrophotometrically using a thorin, morin, or Chrome Azurol S procedure. Since these reagents are not specific for thorium, a prior separation is necessary, involving precipitation, coprecipitation, and ion exchange. These are described in detail.

The Limitations of Urinary Radium as a Measure of Radium Body Load. John B. Hursh. University of Rochester Report UR-522 (April), 1958. (Price $0.50. Available from Office of Technical Services, Washington, D.C.)

Since the radium content of the urine from industrially exposed workers will depend mostly on their very recent exposure history, measurement of urine samples alone does not determine radium body burden. The method may be used to monitor working environment and spot accidents but must be supplemented by radon breath samples if body burden data are to be obtained.

[Author's abstract]

Abstracts

Bronchogenic Carcinoma from Radioactive Cerium Fluoride. Herman Cember,* Joseph A. Watson, and Albert A. Spritzer. A.M.A. Arch. Indust. Health 19:14 (Jan.), 1959. (*Graduate School of Public Health, University of Pittsburgh)

Studies were made of the carcinogenic effects of $Ce^{144}F_3$ diffusely distributed in the lungs of rats at several dosage levels. Thirty micrograms of precipitated particles of a mean size of 1 μ were administered by a tracheal cannula. Specific activities were adjusted to give group dosages of 50, 25, 15, 5, and 0 microcuries. A colony control group received no material. It was calculated that the resultant radiation doses were 21,000, 10,700, 5,100, 2,400, 0, and 0 rad respectively. At the higher doses, some acute lethality resulted. All groups receiving radioactive material developed some cases of squamous-cell carcinoma of the lung, which is not known to occur spontaneously in these rats. Handbook 52 lists the permissible level of Ce^{144} in air to be 7×10^{-9} microcuries per milliliter, which is 3% of a value calculated to result in the smallest dose shown to cause cancer in the rat. It is suggested that the Handbook figure should be more conservative.

Autoradiographic Analysis of Plutonium Deposition in Human Skin. N. L. Dockum* and A. C. Case. Acta radiol. 50:561 (Dec.), 1958. (*Hanford Laboratories, Richland, Wash.)

Autoradiograms were made on serial sections of a biopsy of known plutonium contaminated skin. The films demonstrated that the plutonium existed in discrete particles immediately beneath the epidermis from 700 to 900 microns below the stratum corneum. Counting of the paraffin sections was done, but this was considered less accurate than counting of ashed samples.

OHI PRESENTATION

Lorain Works of U.S. Steel's National Tube Division was awarded the Occupational Health Institute's Certificate of Health Maintenance on March 18. The presentation was made by Paul A. Davis, M.D. (left), OHI regional consultant for eastern Ohio. Accepting the certificate for the Lorain plant are C. V. Province (right), manager of industrial relations, and W. J. Ralston, M.D. chief plant surgeon. Lorain Works' medical staff includes four doctors, 10 nurses, a laboratory technician, a physiotherapist, and a consulting staff of physicians in each medical specialty.

About the Authors

CHARLES L. DUNHAM, M.D., undoubtedly knows more about industrial medicine than industrial medicine knows about him. He is Director, Division of Biology and Medicine, Atomic Enery Commission, Washington, D. C. His numerous responsibilities in that office include surveillance of the occupational health programs in the far-flung research facilities, development installations, and production plants operated for the Commission by various universities and business firms. This is accomplished through a staff of specialists in the various areas that comprise the total field of radiation health. Usually a remote figure to the physicians in the Commission's plants because of the vastness of the total enterprise, Dr. Dunham precipitously becomes impressively real in the tempests that occasionally whirl in that large teapot.

Dr. Dunham took his baccalaureate degree at Yale in 1929 and his doctorate in medicine at the University of Chicago in 1933. There followed 16 years of teaching and research in the department of medicine at Chicago. He joined the Atomic Energy Commission's Division of Biology and Medicine as Assistant Chief of the Medical Branch in 1949, and for a while served as Deputy Director before becoming Director of the Division. For his understanding of radiation problems he draws upon distillations of the enormous research programs supported by the Commission and administered by his Division, as well as upon an active experience of direct inquiry into the more urgent radiation problems in this country and elsewhere. His contribution to this issue is the article "The Implications of Radiation for Occupational Medicine."

ROBERT J. HALEN, M.D., is works physician, Pittsburgh Works, Jones and Laughlin Steel Corporation, Pittsburgh. He was in military service during 1943-1944, after which he attended college and medical school at the University of Pittsburgh. He received the doctor of medicine degree from that institution in 1948. After an internship at Walter Reed Hospital, he once more saw active service, this time as a physician. Upon his return to Pittsburgh in 1951 Dr. Halen started his career in industrial medicine. He attended the training course at the Graduate School of Public Health half-time and concurrently worked part time at the Pittsburgh plant of Jones and Laughlin. He received the M.P.H. degree in 1953, and became physician to the Monongahela Connecting Railroad, which serves neighboring sections of the "J. & L." plant. He was elevated to the post of works physician in 1958. He has had the unusual opportunity of studying industrial medicine problems in two groups of employees who are essentially alike in all respects save the purposes of their respective organizations—railroad transportation and steel production. Dr. Halen is a clinical instructor in the Department of Occupational Health at the University of Pittsburgh, and is on the volunteer clinical staff of its Cardiac Work Evaluation Clinic. He recently presented a paper before the Pennsylvania State Medical Society on Cardiac Problems in Industry. He is certified as a specialist in occupational medicine by the American Board of Preventive Medicine.

STANLEY C. WHITE, M.D., a lieutenant colonel in the Medical Corps of the United States Air Force, is senior author of the article on Space Flight in this issue. Colonel White was recently transferred on loan to the new National Aeronautics and Space Agency (NASA), Space Task Force Group, Langley Research Center, Langley Air Force Base, Va. His assignment in NASA is to form an Aeromedical and Human Factors Team to aid the new agency in its manned space vehicle systems program.

Prior to his assignment with NASA, Colonel White was stationed at Aero Medical Laboratory, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio. He was associated there with research programs dealing with the development of high altitude protective suits, oxygen requirements of men at both low and high altitudes, development of equipment for a man's support in a closed environment as seen on space flight vehicles, development of protective equipment and protective devices for air crewmen, and development of criteria for the selection of crewmen for vehicle flights.

Colonel White's education was received at Miami University, Oxford, Ohio, and at the College of Medicine of the University of Cincinnati. After a year of internship at Charity Hospital of Louisiana (New Orleans), he entered active duty in the U.S. Navy as a medical officer. Within a short time he transferred to the Air Force and entered the aviation medicine residency. The final portion of this was completed at Wright-Patterson and led into the research which engages his present endeavors.

CHARLES L. WILSON, M.D., is a captain in the Medical Corps of the United States Air Force. He is a graduate of Adelbert College and of the School of Medicine, Western Reserve University, Cleveland, Ohio. After a year of internship and a second year of residency in internal medicine at St. Luke's Hospital, Cleveland, Dr. Wilson entered active duty with the Air Force in 1957. He has been associated with the Respiration Section, Aero Medical Laboratory, Wright-Patterson Air Force Base, Ohio. Among his responsibilities, are those of medical monitor on all high altitude pressure test suits, coordinator for crew selection programs, and flight surgeon. He is junior author of the article on Space Flight in this issue.

HARRIET L. HARDY, M.D., is senior author of the topical review, "Beryllium Disease: Review of Current Knowledge," in this issue. She has been prominently identified with the clinical and epidemiological study of beryllium disease since this condition attracted attention, almost 15 years ago. Beginning with a paper in 1946 on delayed chemical pneumonitis in workers exposed to beryllium, she has produced a total of 16 articles and reviews on the various aspects of beryllium-caused disease, some in association with co-authors. She is author or co-author of 20 other articles, a textbook, and chapters in four other books, all dealing chiefly with industrial intoxications.

Dr. Hardy's education was achieved at Kent Place School, Wellesley College, and the medical school of Cornell University. An internship at the Philadelphia General Hospital was followed by five years as school physician to Northfield (Mass.) Seminary and another five years in a similar service to Radcliffe College in Cambridge. Early in the latter period she received her first appointment to the staff of Massachusetts General Hospital as a graduate assistant in medicine. There followed a progression to the status of associate physician to the hospital and chief of its occupational medical clinic.

In her present appointments Dr. Hardy is associate professor of preventive medicine at Harvard Medical School, assistant medical director in charge of occupational medical service at Massachusetts Institute of Technology, and consultant in industrial medicine to a long list of agencies. She is a member of Phi Beta Kappa honor society and Alpha Omega Alpha fraternity and a founder member in occupational medicine of the American Board of Preventive Medicine.

LLOYD B. TEPPER, M.D., is co-author of the article "Beryllium Disease: Review of Current Knowledge," with Dr. Harriet L. Hardy. His appointments in connection with a residency in occupational medicine include research fellow in preventive medicine at Harvard Medical School, clinical fellow in occupational medicine at Massachusetts General Hospital, and research assistant in occupational medicine at Massachusetts Institute of Technology. Dr. Tepper is a graduate of Dartmouth College and of Harvard Medical School. He entered his present course of training in occupational medicine after a year of internship at the University of California in San Francisco.

LIEUT. CMDR. NORBERT E. ROSENWINKEL (MC), U.S.N., is senior author of our extensive topical review, Noise and Hearing Loss, scheduled to appear in six parts at quarterly intervals. The second part is presented in this issue.

Commander Rosenwinkel is a native of the industrial city of Hammond, Indiana, where he received his primary and secondary education. His premedical studies were accomplished at the University of Nebraska. His M.D. degree was earned at Louisiana State University in 1949, the year he was commissioned in the Navy Medical Corps. He attended the U.S. Naval School of Aviation Medicine, Pensacola, Florida, and was rated as a Flight Surgeon in 1951.

Commander Rosenwinkel began graduate training at the Graduate School of Public Health, in the program in occupational health in 1954, and at the end of that academic year was awarded the M.P.H. degree. After an interval of two years, during which he was in charge of a naval industrial dispensary, he returned to Pittsburgh to conduct a field research project relating industrial noise to hearing loss which eventuated in his receipt of the Dr.P.H. degree. His advisers during this project were Mr. Kenneth C. Stewart and Dr. Leo G. Doerfler, of the Pittsburgh faculty, who serve now as junior authors of the review series. Dr. Rosenwinkel is currently assigned as Head, Industrial Medical Division, Medical Department, Norfolk Naval Shipyard, Portsmouth, Virginia.

An Exclusive Privilege of I.M.A. Membership

. . . 2 Officially Sponsored Group Insurance Programs

PROGRAM No. 1—Accident-Sickness Disability Income Benefits. You receive up to:

$10,300.00
(Tax Free Income)

for disabling sickness and hospital benefits. Additional benefits for disabling accidents and hospital benefits up to:

$34,700.00
(Tax Free Income)

PROGRAM No. 2—World-Wide Accidental Death, Loss of Limbs & Eyesight Protection up to

$200,000.00

(Member's Spouse May Also Apply)

This Group Security is for Members and Their Families at Low Group Premiums.

This coupon entitles you to a 1959 Up-to-date Portfolio of I.M.A. coverages and rates.

MAIL TODAY TO:

I.M.A. Group Insurance Administration Office
Joseph K. Dennis Company, Inc. Counsellors & Administrators
Suite 1027—Insurance Exch. Bldg.
175 W. Jackson Blvd., Chicago 4

Please send me descriptive material and rates for the following:

☐ No. 1—Accident-Sickness Disability Income Program
☐ No. 2—Accidental Death & Dismemberment Program

Name_____

Age_____ (Member) Age_____ (Spouse)

Address_____

City & State_____

People and Events

► JOSEPH B. TAUBER, M.D., has been appointed Works Physician at the Aliquippa Works, Jones and Laughlin Corporation. He succeeds the late J. A. VOGEL, M.D.

DR. TAUBER is a native of Czechoslovakia, and received most of his early education and medical training in that country. He has been Assistant Works Physician at the Jones and Laughlin Aliquippa Works since January 1955. Prior to that time, he was a Research Fellow in Industrial Medicine at the University of Pittsburgh Graduate School of Public Health.

During World War II, DR. TAUBER served as Medical Officer in the Royal Netherlands Navy. His postwar experience includes a position as a Medical Officer for the United Nations Relief and Rehabilitation Administration, Geneva, Switzerland. Prior to World War II DR. TAUBER served with the Czechoslovakia Ministry of Health. He received his Medical Doctorate from the University of Prague Medical School. Part of his undergraduate medical studies were at the University of Paris and the University of Munich. He has done graduate work at the Tropical School of Medicine, Liverpool, England; Malaria Research Institute, Portuguese East Africa; and the University of London.

His published papers include research on Malta Fever and on the Netherland children in England. He also has written papers on the prevalence of disease of the heart in an urban center, and on the magnitude of the heart disease problem. He is the co-author of a paper entitled, "Household Survey, Industrial Interview, and Clinical Examinations to Determine the Prevalence of Heart Disease."

► LYNN E. HOLLIS, M.D., has been named Chief Physician, and WILFRED N. SISK, M.D., Assistant Physician, for the Phillips Petroleum Company in Phillips, Texas. DR. HOLLIS, who was formerly Assistant Physician, succeeds H. W. HOLLINGSWORTH, M.D., who has resigned to enter private practice in Diaball, Texas. DR. HOLLINGSWORTH had been Chief Physician since 1952. DR. SISK was formerly head of the industrial health department of The Upjohn Company, Kalamazoo, Michigan. He assumed his new position on March 1.

The Phillips Medical Center at Phillips, Texas, includes a 25-bed hospital as well as the usual facilities for industrial medicine. This unit cares for the industrial medical needs of the Phillips Petroleum Company in Borger, Phillips, and the surrounding territory.

Before joining Phillips, DR. HOLLIS was chief, Preventive Medicine and Occupational Health Services Branch, Tinker Air Force Base, Oklahoma, from 1943 to 1958. His medical degree was received from the University of Texas School of Medicine in 1933. He interned at Columbia Hospital in Milwaukee, and has done postgraduate work at New York University Post Graduate Medical School.

DR. SISK obtained his M.D. degree from the University of Wisconsin Medical School in 1935, and later earned a Master of Public Health degree at Johns Hopkins University. He is a Fellow of the Industrial Medical Association, and was IMA District Counselor for the State of Michigan until moving to Texas. He is also a Fellow of the American Public Health Association, a diplomate of the American Board of Preventive Medicine and Public Health, and a member of the American Industrial Hygiene Association.

► AUSTIN SMITH, M.D., former Editor of the *Journal of the American Medical Association*, has been named by the Pharmaceutical Manufacturers Association as its first full-time salaried president. This action was taken at the first annual meeting of the Association at Boca Raton, Florida on April 3.

Since the merger of the American Drug Manufacturers Association and the American Pharmaceutical Manufacturers Association last year the new PMA represents 140 manufacturers. The enlarged scope of its activities prompted the Association to create a full-time salaried chief administrative office. DR. SMITH will be located at PMA's Washington, D. C. headquarters.

Since 1941, DR. SMITH has served in various capacities with the American Medical Association. He was with the Council on Pharmacy and Chemistry until 1949 and Director, Division of Therapy and Research, during the period. In 1949, he was named Editor and Managing Publisher of the *Journal of the American Medical Association*, and Editor-in-Chief and Managing Pub-

People and Events

lisher of the scientific publications of the AMA.

DR. SMITH has been Executive Editor of the World Medical Journal since 1953, and Chairman of the Board of the U.S. Committee, World Medical Association, since 1954.

DR. SMITH, who is a native of Belleville, Ontario, Canada, received his medical degree from Queens University, Faculty of Medicine, Kingston, Ontario, in 1938. He has been an American citizen since 1943. He is author and editor of a number of scientific books.

► WILLIAM A. MCCLELLAN, M.D., assumed the position of Director of Clinics of Milwaukee County Hospital on April 1. DR. MCCLELLAN formerly held a full-time teaching position in the Division of Preventive Medicine at the University of Tennessee. Prior to that, he did industrial work for the National Lead Company and the Procter and Gamble Miami Valley Laboratory.

DR. MCCLELLAN attended Miami University, Oxford, Ohio, and received his M.D. degree from Western Reserve University School of Medicine in 1943. He is a member of the Industrial Medical Association, and has been elected to Fellowship. He will receive his certificate of Fellowship at the annual business meeting of IMA April 29.

► REAR ADMIRAL I. L. V. NORMAN (MC), U.S.N., is retiring from the Navy to accept the position of Medical Director for the Chase Manhattan Bank in New York City. He will assume his new position on May 1.

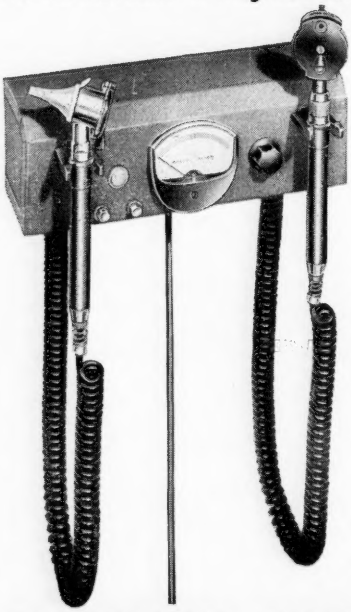
ADM. NORMAN received his M.D. degree from the University of Minnesota Medical School in 1928, and interned at the U.S. Naval Hospital in Chelsea, Massachusetts. He has served at many posts throughout his naval career. During World War II, he was assistant naval attaché at the U.S. Embassy in London. He was also a member of the Harriman-Beaverbrook Mission to Russia in 1941-42. The position he is leaving is that of Inspector General, Bureau of Medicine and Surgery in Washington, D. C.

► The American Academy of Occupational Medicine's annual award to a physician whose work in the field of occupational medicine has been outstanding, was awarded to JAMES H. STERNER, M.D., at the Academy's annual banquet in New York City February 12. DR. STERNER is Medical Director, Eastman Kodak Co., Rochester, N. Y. Also honored at the banquet was PROFESSOR PHILIP DRINKER of the Harvard School of Public Health, who delivered the George Gehrmann Lecture. The banquet was held as a part of the Academy's 11th Annual Meeting.

Officers elected at the business meeting are as follows: LEONARD J. GOLDWATER, M.D., President; J. QUIGLEY, M.D., Vice-President; JAMES H. MCDONOUGH, M.D., Treasurer; CAPT. LLOYD B. SHONE (MC) USN, Secretary. LOMAX WELLS, M.D. was elected to the Board of Directors.

► Nineteen members of the Industrial Medical Association were participants in the Fourth Annual Seminar, "Maintaining Emotional Health," at the Menninger Foundation in Topeka, Kansas, March 2-6. They include: WALTER O. BLANCHARD, M.D., Medical Director, Raytheon Manufacturing Co., Waltham, Mass.; LUTHER A. CLOUD, M.D., Assistant Medical Director,

Welch Allyn No. 745 Wall Transformer Unit....$60.00 (No instruments included.) Just lift the instrument. It's lighted and ready to use. Handles for two instruments. Saves frequent changing of heads. Maximum brilliance of illumination without overloading lamps is assured with rheostat and easily read volt meter. Lamps last longer. Binding cord provided for cord tips. No battery replacements. Light weight handles. Eight foot cord on each handle — wide scope of use without trading or extension cords. Complete line of WELCH-ALLYN diagnostic sets and transilluminators, in stock.



Chesebrough Vaseline, Sterile Petrolatum Gauze

½" x 72"	Box of 6	**$2.45** per box
1" x 36"	Box of 6	**1.18** per box
3" x 3"	Pad—3 ply opens to 3" x 9" strip—box of 6	**1.29** per box
3" x 18"	Strips—box of 6	**1.37** per box
3" x 36"	Strips—box of 6	**1.84** per box
6" x 36"	Strips—box of 6	**3.03** per box

Special Situation Inquiries Invited. Now supplying large Industrial Medical Departments with their Drug, Medical, Hospital, Surgical and Sundry supply needs. PHONE OR WRITE.

MIDWEST HOSPITAL & SURGICAL SUPPLY CO.

Chicago (21) Phones HU 3-2066-67 7209 So. Halsted St. Illinois

The Equitable Life Assurance Society of the United States, New York City; WILLIAM T. DORAN, JR., M.D., Medical Director, The Engineer Center, Department of Defense, Fort Belvoir, Va.; MATTHEW E. FAIRBANK, M.D., Industrial Physician, Eastman Kodak Co., Rochester, N. Y.; STANLEY GREENHILL, M.D., Consulting Physician, Edmonton, Alberta, Canada; JAMES C. HAYES, M.D., Chief Physician General Office, United States Steel Corp., Pittsburgh; DAVID D. HOLADAY, M.D., Western Area Physician, American Can Co., San Francisco; EDWARD G. KIDD, M.D., Plant Physician, Northwest Industries, Ltd., Edmonton, Alberta, Canada; CHARLES F. MARTIN, M.D., Plant Director, International Business Machines Corp., Newtown Pike, Lexington, Ky.; JACK MASON, M.D., Staff Physician, Illinois Bell Telephone Co., Chicago; GORDON W. PETERSEN, M.D., Medical Director, Kimberly-Clark Corp., Neenah, Wis.; BENSON T. ROGERS, M.D., Eastern Regional Medical Director, The Bell Telephone Company of Canada, Montreal, Quebec, Canada; HENDRIK M. ROZENDAAL, M.D., Physician, General Electric Research Laboratory, Schenectady; HELEN J. SCHLAGEL, M.D., Staff Physician, Boeing Airplane Co., Seattle; JAMES K. STEWART, M.D., Assistant Medical Director, Magnolia Petroleum Co., Dallas; JAMES R. THOMAS, M.D., Assistant Medical Director, Gulf Oil Co., Port Arthur, Tex.; WILLIAM D. VAN RIPER, M.D., Director of Industrial Medicine, Johnson & Johnson, New Brunswick, N.J.

► The Industrial Medical Association of Philadelphia and the Industrial Nurses Association of Philadelphia held a joint meeting March 25. The guest speaker was AIMS C. MCGUINNESS, M.D., Special Assistant to the Secretary of Health, Education, and Welfare. He was formerly Clinical Director of the United Mine Workers Hospital Program.

On May 4, the Philadelphia chapter of the American Society of Safety Engineers will be host at a plant visitation and joint meeting with the Industrial Medical Association of Philadelphia, the Industrial Nurses Association of Philadelphia and the Philadelphia Section of the American Industrial Hygiene Association. Dinner will be served in the cafeteria of the Bayuk Cigar Company, and a plant tour will be conducted following the meeting, which will feature a panel discussion on the subject, "Working Together for Employees' Industrial Health."

► The Research Center of the Sub-Committee on Noise (Committee on Conservation of Hearing, American Academy of Ophthalmology and Otolaryngology) has just completed a 16-mm, sound, color film entitled, "Ear Protection in Noise." The film was made to emphasize to employer and employee the need for protecting their hearing in noise and how to go about it. It runs about 14 minutes long, and is now available for showing. There is no rental charge. The only charge is for the postage to and from the Research Center. The address is 111 North Bonnie Brae St., Los Angeles 26.

► At a meeting in Boston on February 4, the New England Industrial Medical Association elected the following officers and directors: President—NORMAN WHITE, M.D., Vice-President—FRANCIS LE BARON, M.D.; Secretary-Treasurer—JAMES I. ROBERTS, M.D.; Directors: G. GARFIELD DEFOE, M.D.; JOHN MALLOY, M.D.; HARRY MUSHLIN, M.D.; A. DUNCAN MACDOUGALL, M.D.; and WILLIAM D. THIBODEAU, M.D.

On May 20, the New England Industrial Medical Association will hold a luncheon meeting in conjunction with the Section on Industrial Health of the New England Industrial Medical Association. The speaker will be WARREN F. DRAPER, M.D., who has been Executive Medical Officer, Welfare and Retirement Fund, United Mine Workers of America since 1948. His subject will be "How May Good Medical Care at Right Cost Be Best Obtained?"

► "Back on the Job," a new film which shows how a heart attack victim is returned to useful employment with the aid of a Heart Association-sponsored Cardiac Work Evaluation Unit, has been produced for the American Heart Association. It is a 16-mm, black and white sound film which runs 14½ minutes long. It is being distributed throughout the country for showing to the general public over television and at meetings of physicians, state and county medical societies, social workers, nurses, management and union groups and rehabilitation workers, among others.

► Aero Medical Association will hold its 30th annual meeting at the Statler Hilton Hotel in Los Angeles, April 27-29, 1959.

Industrial

BIO-TEST

Laboratories,

Inc.

TOXICOLOGY

Biological Evaluations

Consultation

Radiochemistry

Biochemistry

Microbiology

Pharmacology

Write for Brochure

1810 Frontage Road

Northbrook, Illinois

Crestwood 2-3030

People and Events

The scientific program features simultaneous sessions both morning and afternoon throughout the three day meeting, in addition to a symposium each day. A total of 159 papers are listed in the advance program. Some of the general subjects to be considered are: Aviation Pathology and Accident Investigation; Development and Testing of Personal Protective Equipment; The Inner Ear; Medical Problems of Business and Private Flying; Physiology of Acceleration; Aeromedical Aspects of Stress; Thermal Control and Respiration, and Weightlessness.

► "Health Engineering in the Space Age," is the theme of the Fifth Occupational Health Conference to be held at the University of Texas, Austin, on May 8. The meeting is jointly sponsored by the Civil Engineering Department, College of Engineering, University of Texas; the Division of Occupational Health of the Texas State Department of Health and the North Texas and Gulf Coast Sections of the American Industrial Hygiene Association.

Formal presentations will include: "New Challenges in the Petrochemical and Chemical Industries"—ELMER P. WHEELER, Assistant Director, Medical Department, Monsanto Chemical Co., St. Louis; "Calibration of Andersen-Type Cascade Impactor"—W. B. HENEVELD, Nuclear Engineer, Convair, Ft. Worth; "Noise Exposure Criteria for Preservation of Health"—MAJOR RALPH F. THOMPSON, Wright Air Development Center, Wright Patterson Air Force Base, Ohio; "The Toxicology of Some Newer Heavy Metals"—HERBERT E. STOKINGER, PH.D., Occupational Health Field Headquarters, U.S. Public Health Service, Cincinnati; "Industry and Education as Partners"—F. LANIER COX, Vice-President, Administrative Services, The University of Texas; "Phosgene Production from Welding and Ultra-Violet Sources"—EDWARD W. POTH, JR., Chief, Sanitary and Industrial Hygiene Engineering Section, Kelly Air Force Base, Texas; "Insurance in Industrial Health"—GARLAND NEAL, Superintendent of Engineering, Texas Employers' Insurance Association, Dallas; "Medical Concern in Space Flight"—COL. G. L. HEKHUIS, Department of Radiology, School of Aviation Medicine, USAF, Randolph Air Force Base, Texas; "Respiratory Protection for Radioactive and Other Highly Toxic Aerosols"—E. C. HYATT, Group Leader, Industrial Hygiene Group, Los Alamos Scientific Laboratory, N.M.

List of Advertisers

Aloe, A. S., Co. *7a*
Cereal Institute, Inc. *1a*
Chesebrough-Pond's, Inc. *18a*
Dennis, Joseph K., Co. *21a*
Fleet, C. B. Co., Inc. *2a*
Industrial Bio-Test Laboratories *23a*
Karel First Aid Supply Co. *13a*
McNeil Laboratories *9a*
Midwest Hospital and Surgical Supply Co. *22a*
Parke, Davis & Co. *11a*
Pitman-Moore Company ..*2nd cover*
Sperry Gyroscope Co......*4th cover*
Squibb, E. R., & Sons ....*5a and 17a*
Syntex Chemical Co., Inc. *15a*
Winthrop Laboratories, Inc. .....*3rd cover*
Vitamins for Industry *24a*

SPECIALIZATION is a familiar term to the INDUSTRIAL PHYSICIAN

Although there is no "Certification" board nor committee to determine that we are, or are not *specialists*, we have been doing ONE job only for 17 years—

PROVIDING FINE QUALITY VITAMIN DIETARY SUPPLEMENTS TO WORKERS IN INDUSTRY AND COMMERCE.

We think the hundreds of discriminating companies which use our products and service, signify an *earned title.*

Although best known in the West
We ship anywhere in the U. S.

Vitamins **FOR INDUSTRY, INC.**
3456 WEST OLYMPIC BOULEVARD, LOS ANGELES 19, CALIFORNIA

Catalog available